Vol. XXX. — No. 6. June 1953.

BULLETIN
OF THE
INTERNATIONAL RAILWAY CONGRESS
ASSOCIATION
(ENGLISH EDITION)

[625 .212 (485)]

Dynamic forces on railway wheel sets,

by K. R. MELDAHL, ASEA, Västerås, Sweden.

Swedish engineering circles have long been conscious that greater attention should be given to the problem of correctly dimensioning and forming wheel sets for rail cars. This has brought about intensive development work and as a result we certainly know more about the problem now than we did six years ago. This work has, however, not simplified the original problem. The economically insignificant detail represented by a wheel set, compared with the total rolling stock, does not justify that the problem be treated lightly, as a defect in this element may have far more serious consequences than an equivalent defect in several other parts. This paper mainly treats the forces acting on the wheel set, the theoretical deduction of these forces taking up a large part of this article. This is considered necessary as the measurements by themselves are often more misguiding than guiding. A considerably better and more graded evaluation of the measured results has been made possible with the aid of the theoretical deductions.

Form giving and material questions, which have also been thoroughly investigated, have not been included in order to prevent undue scattering of the subject matter. These questions are admittedly equally important as the forces acting and their calculation.

The theoretical treatment of wheel sets considered as a system in oscillation.

Present methods of calculation.

The methods of calculation for the dimensioning of wheel sets used in Sweden and a number of other countries are based on the usual strength of materials calculations plus empirical values and certain tests, both operational and laboratory tests (1) (2).

The wheel set is acted upon by horizontal and vertical forces on the wheels and by the reactions of the axle boxes on the journals as shown in figure 1. The vertical force on one wheel is assumed to consist partly of the static journal force P_0 and partly of a dynamic addition P. The horizontal force F, which is assumed to have its reaction in the centre of gravity of the car TP, is a dynamic force acting between the side of the rail head and the flange of the wheel. The forces P and F are unknown and ensue from the tendency of the car to diverge from the theoretical path whilst in motion (curves, switches, rail joints and similar are the cause of these divergences). The vertical addition P consists of two components different in kind. A condition of oscillation of the carriage chassis and the bogies due to the general unevenness of the track, irregular driving and braking causes variations in the axle box forces; and the passing of rail joints, crossings and switches also causes blows of such duration that their effects for the greatest part remain within the wheel set in the form of vibrations. The flange forces are caused partly by the transverse movement between the rails on the straight track (sinusoidal movement) and partly by changes in the direction of the track (switches, start and finish of curves) and due to the effects of the centrifugal forces when travelling in curves. These various causes are combined to a complex in that the primary causes of the vertical addition also influence the flange forces and vice versa.

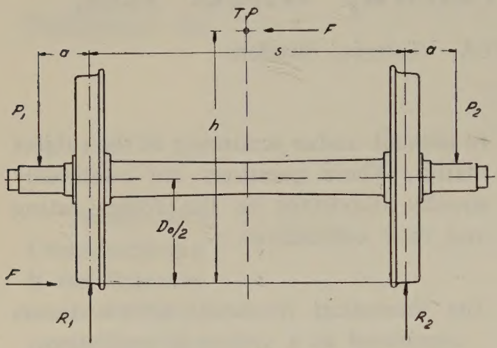


Fig. 1. — Wheel set with acting forces.

Considering first of all the vertical forces and the flange forces separately, their journal reactions can be deduced and the bending moment diagram for the axle be drawn up, which is shown in figures 2*a* and 2*b*. The flange force can, of course, act either on the one or the other wheel, which is indicated by the dotted bending moment curve in figure 2*b*.

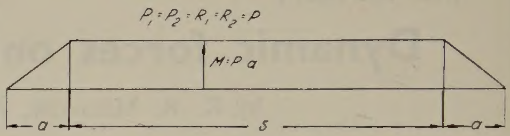


Fig. 2*a*. — Bending moment diagram for vertical dynamic forces.

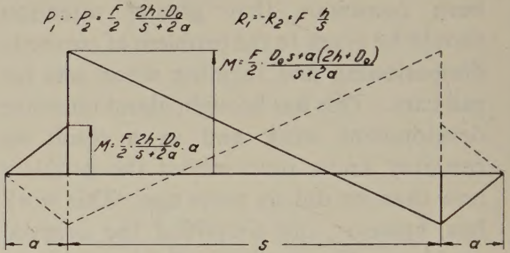

$P_1 = -P_2 = \frac{F}{2} \cdot \frac{2h - D_0}{s + 2a}$
$R_1 = -R_2 = F\,\frac{h}{s}$
$M = \frac{F}{2} \cdot \frac{D_0 s + a(2h + D_0)}{s + 2a}$
$M = \frac{F}{2} \cdot \frac{2h - D_0}{s + 2a} \cdot a$
a
s
a

Fig. 2*b*. — Bending moment diagram for flange forces.

Figure 3 shows the combined bending moment diagram, which also includes the effect of the static force P_0. It can be seen that the bending moment curve shows an instability at the wheel seat with the consequence that the maximum bending moment occurs at this point.

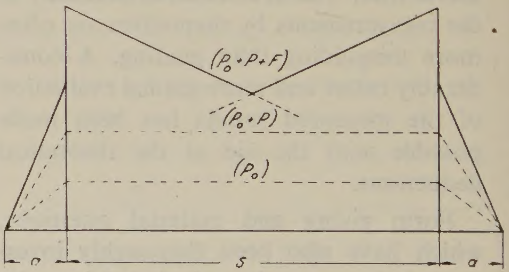


Fig. 3. — Combined bending moment diagram.

It is thus possible to calculate the stresses assuming that the dynamic forces P and F and the conditions for their simultaneous occurrence are known.

For normal car springs and a speed of 100 km/h (62 m.p.h.) the vertical force P shall be taken as 40% and the dynamic flange force F as 70% of the wheel pressure P_0 according to the Royal Railway Board of Sweden. Correction curves are provided for other springs and speeds. Finally under consideration of shrink stresses in the wheel seat and stress concentration factors at fillets and grooves the maximum stress for every axle section is laid down, this stress not exceeding a certain value depending on the quality of the axle material. This value has been laid down as 12 kp/mm^2 (7.6 T./in.^{2}) for the Surahammars Bruks AB's axle steel. The wheel webs can be calculated for the flange force F with the moment Fr. As the webs are subject to corrosion and high internal stresses arising partly from the shrinking on of the tyre and partly from manufacture, the permitted stress has been chosen very low.

Damage of wheel sets.

Three defects of a more serious nature occur mainly on railway wheel sets, namely fracture of the axle at the inside of the wheel hub, fracture of the journal at the inside of the bearing and fracture in the web. Working loose of the tyres, running hot in the bearings and damage to the tyre tread may further occur. Fracture of the journal stub is most often caused by running hot, primarily in sliding bearings. This fault is becoming more unusual due to improved bearings and the transition to roller bearings. Web fractures occurred earlier to a great extent due to stress concentrations around the carrier holes. As these are now becoming obsolete even this risk will decrease as long as webs are as heavily dimensioned as now.

Wheel seat fractures have also become more unusual, but are still considered the most treacherous fault of all that can occur. The number of fractures could up to now only be decreased by increasing dimensions and partly by improved form design, as it has been assumed in advance that the forces acting on the wheel set can not be altered.

Criticism of the existing methods of calculation.

Considering the above quoted direction for calculation, i.e. $P = 0.4\ P_0$ and $F = 0.7\ P_0$, and assuming that these dynamic forces occur simultaneously we can calculate the bearing reactions to $P_0 + P \pm F \frac{h - r}{s + 2a}$. For an ordinary wheel set we obtain from this $P_0 + P \pm 0.6\,F$ or $P_1 = 1.82\ P_0$ and $P_2 = 0.98\ P_0$. One axle box is thus subject to a force 82% greater than the static loading. The axle box springs are usually limited by metal to metal contact at approximately 40-50% of the maximum static loading and springs of existing dimensions would certainly not endure a load increase of 82%. As furthermore axles break even if calculated according to the above directions, it must be assumed that greater forces occur. These forces obviously do not make themselves known in the axle box springs, otherwise metal to metal contact could be expected at a totally different rate to that really occurring. These forces, which thus can never be measured at the axle box springs but all the same seem to play a decisive part for the carrying capacity of wheel sets, seem to be of a vibration-technical character and observable only by measurement directly, for example, on the axle of the wheel set.

It is perhaps not so well known that WÖHLER (3) carried out both bending and torsion tests already 1856-57 directly on the wheel axles under operational conditions and that this led indirectly to the discovery of the phenomena of fatigue. WÖHLER states at one place that the torsion stresses are approximately only 20% of the bending stresses. The resultant stress for combined torsion and bending is thus according to the theory of distortion (VON MISES and HEMKY) only 7 % greater than the bending stress. The torsion occurring through both wheels of a set rolling at different speeds to each other (curves, etc.) has therefore been neglected in this paper.

It may finally be assumed that a constant fixed additional force does not correspond to the real conditions. Both the flange force F and the vertical dynamic force P vary in such a way that lesser forces occur often whilst the greater forces are more rare. The distribution function of these forces can be determined by measurements and on the basis of this the carrying capacity of the wheel set may be calculated. This distribution will further enable an estimate of the length of life to be made and give a basis for the comparison of different types of wheel sets. It can be expected that the measurements will give occasional stress peaks lying considerably over the values accepted up to now.

BÄSELER (4) has recently said that the oscillation system rail-wheel set is of the greatest importance for the understanding of the play of forces in the wheel set. This opinion agrees with the ideas behind this investigation and which were current a short time after the first measurements were carried out in 1947.

The vertical dynamic forces.

Consider a wheel set rolling on springy rails with a car mass sprung against the journals of the wheel set as shown in figure 4*a*. This system is considered only with regard to oscillations in a vertical direction. As the course of oscillation on rail joint blows, i.e. resonance oscillations in the wheel set itself, will be treated first, we can as a good approximation assume that the car mass is at rest relative to the track bed. The spring constant k_1 corresponds to the springing of the axle box, whilst k_{12} corresponds to the springing of the axle itself. The springing of the rails and the rail support

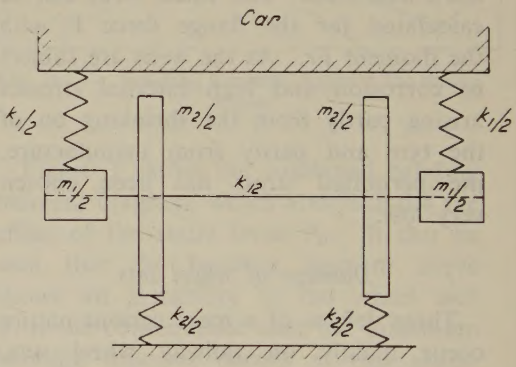


Fig. 4*a*. — The system car-wheel set-track.

is finally expressed by the constant k_2. The mass of the axle boxes and the journal stubs is m_1 and the remaining mass of the wheel set (both wheels + approx. one half of the body portion of the axle) is called m_2. If we assume that the system obtains quite symmetrical impulses, i.e. equally great rail joints at the same moment act upon both wheels, we can reckon with a simplified oscillation system as shown in figure 4*b*. This should qualitatively correspond to reality. Damping is disregarded in the calculations as also this in a qualitative respect hardly influences the result. We are mainly interested in the deformation of the axle, which is expressed by the amplitude $x_1 - x_2$. The following constants are introduced:

$$\omega_1^2 = \frac{k_1 + k_{12}}{m_1}; \quad \omega_2^2 = \frac{k_2 + k_{12}}{m_2};$$

$$\mu_1^2 = \frac{k_{12}}{m_1}; \quad \mu_2^2 = \frac{k_{12}}{m_2}.$$

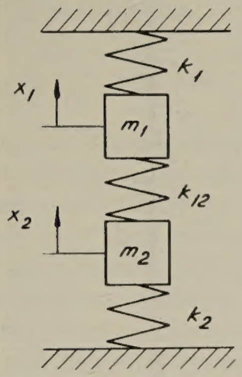


Fig. 4*b*. — Equivalent system.

m_1 = mass of journal of axle and axle box.
m_2 = reduced mass of wheel set.
k_1 = constant for axle box springs.
k_{12} = constant for axle deflection.
k_2 = constant for track deflection.

By transforming and combining the following differential equations :

$$\left.\begin{aligned} m_1\ddot{x}_1 + k_1x_1 + k_{12}(x_1 - x_2) = 0; \\ m_2\ddot{x}_2 + k_2x_2 + k_{12}(x_2 - x_1) = 0 \end{aligned}\right\} \quad (1)$$

a fourth order homogeneous differential equation for x_1 is obtained:

$$\overset{4}{x}_1 + \ddot{x}_1(\omega_1^2 + \omega_2^2) + x_1(\omega_1^2\omega_2^2 - \mu_1^2\mu_2^2) = 0$$

the solution of which is

$$x_1 = \mathrm{A} \sin p_1t + \mathrm{B} \cos p_1t + \mathrm{C} \sin p_2t + \mathrm{D} \cos p_2t \quad (2)$$

where the following resonance frequencies are obtained :

$$p_{1,2}^2 = \frac{\omega_1^2 + \omega_2^2}{2} \pm \sqrt{\left(\frac{\omega_1^2 - \omega_2^2}{2}\right)^2 + \mu_1^2\mu_2^2}$$

For an ordinary Swedish wheel set (SJ type 21) $m_1 \approx 250$ kg (550 lb), $m_2 \approx 1\,000$ kg (2 200 lb) and $k_{12} \approx 14\,000$ kp/mm (780 000 lb/in.). For an ordinary guard's van $k_1 \approx 125$ kp/mm (7 000 lb/in.). It is rather awkward to determine k_2, but in the bibliography (5) (6) (7) certain investigations are given which permit putting $k_2 = 2\,000 - 5\,000$ kp/mm (112 000 — 280 000 lb/in.). We obtain as result the following frequencies :

$$\nu_1 = \frac{p_1}{2\ \pi} \approx 110 \text{ cycles/sec.};$$

$$\nu_2 = \frac{p_2}{2\ \pi} \approx 4 \text{ cycles/sec.}$$

On measuring the oscillations of the axle box of a motored bogie train (G.D.G. Express) oscillations of the type shown in figure 5 were obtained and frequencies with a mean value of approximately 100 cycles/sec. were measured wherefore this theory should give correct results in this respect. Substituting x_1 according to equation (2) in (1), the following is obtained for $x_2 - x_1$:

$$(x_2 - x_1) = \left(\frac{\omega_1^2 - p_1^2}{\mu_1^2} - 1\right)(\mathrm{A} \sin p_1 t + \mathrm{B} \cos p_1 t) + \left(\frac{\omega_1^2 - p_2^2}{\mu_1^2} - 1\right)(\mathrm{C} \sin p_2 t + \mathrm{D} \cos p_2 t)$$

We shall consider only the effect of the rail joints, as we can assume with certainty that a rail blow is the only impulse which is capable of starting these resonance oscillations. The system is considered at rest until reaching a joint. At the time $t = 0$ the impulse is released and we have the start conditions:

$$t = 0\colon\ x_1 = x_2 = \dot{x}_1 = 0;\quad \dot{x}_2 = \Delta v$$

The wheels are thus assumed to have obtained a vertical change in velocity Δv.

This gives us for the constants:

$$\mathrm{B} = \mathrm{D} = 0;$$

$$\mathrm{A} = -\mathrm{C}\frac{p_2}{p_1} = -\frac{\Delta v}{p_1}\,\frac{\mu_1^2}{p_1^2 - p_2^2}$$

and:

$$(x_2 - x_1) = -\frac{\Delta v}{p_1^2 - p_2^2}\left(\frac{\omega_1^2 - p_1^2 - \mu_1^2}{p_1} \sin p_1 t - \frac{\omega_1^2 - p_2^2 - \mu_1^2}{p_2} \sin p_2 t\right)$$

As we have established above that $k_1 \ll k_{12}$, we can without hesitation put $\mu_1^2 = \omega_1^2$, and obtain

$$(x_2 - x_1) = \frac{\Delta v}{p_1^2 - p_2^2}(p_1 \sin p_1 t - p_2 \sin p_2 t).$$

We are interested in the first maximum value for $(x_2 - x_1)$ which, owing to p_1 always being at least 10 times greater

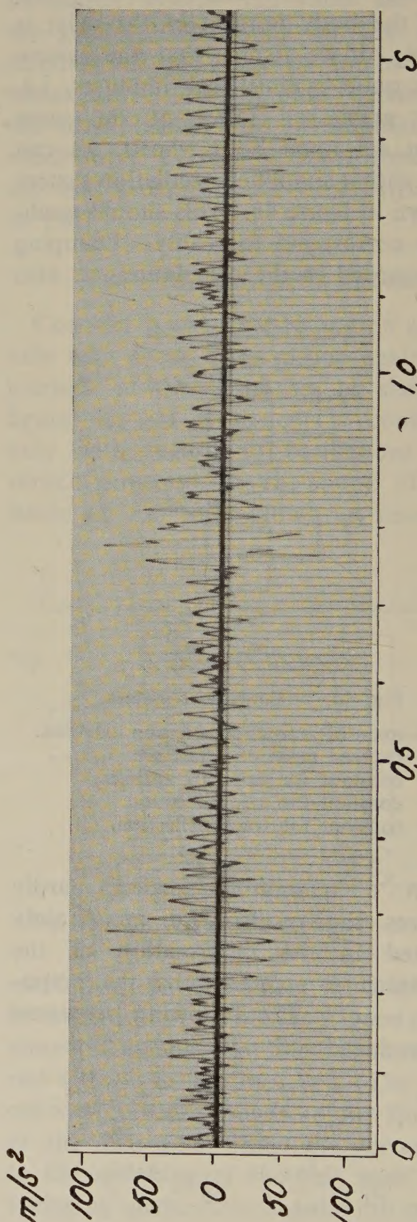


Fig. 5. — Vertical axlebox accelerations of driven axle on train x 0 a 8 (GDG express). Train speed: 135 km/h. (85 m.p.h.) on line Gårdsjö-Töreboda 24.2.1948.

than p_2 (in the above example $p_1 \approx 27\,p_2$), will occur at $p_1 t \approx \pi/2$. If we further take into consideration that $p_2^2 \ll p_1^2$, we obtain:

$$(x_2 - x_1)_{max\,1} = \frac{\Delta v}{p_1} \text{ for } t \approx \pi/2\,p_1$$

The following static deformation is obtained for the static load p_0:

$$(x_2 - x_1)_0 = \frac{P_0}{k_{12}},$$

wherefore the relative vertical addition due to rail blows becomes:

$$\varphi_1 = \frac{(x_2 - x_1)_{max}}{(x_2 - x_1)_0} = \frac{\Delta v k_{12}}{p_1 P_0} \qquad (3)$$

It remains to establish a qualitatively acceptable expression for Δv. A rail joint consists mainly of two rails supported continuously over their entire length on the track bed, a more or less good transmission of bending moments and shear forces taking place between their ends. That the rails may be taken as continuously supported on elastic foundations as a good approximation appears from the bibliography (5) (8) (9).

When a wheel passes a joint one rail end will due to this be pressed down and carries only to a certain extent, depending upon the ability of the joint to transmit shear forces, the adjacent end with it. The wheel will thus with a blow hit the somewhat projecting rail end and thereby obtain a vertical change in velocity Δv. We consider first a joint unable to transmit any shear force and then introduce a constant expressing the quality of the joint.

We obtain the following equations for the determination of the path of the wheel centre, using the system of notation shown in figure 6*a*:

$$y = \sqrt{\frac{D_0^2}{4} - x^2} - z_2; \qquad P_1 + P_2 = P_0$$

$$z_1 = \frac{P_1}{k_2} = \frac{D_0}{2} - y; \qquad z_2 = \frac{P_2}{k_2} = \frac{P_0}{k_2} - z_1$$

From this we obtain:

$$2\,y = \frac{D_0}{2} - \frac{P_0}{k_2} + \sqrt{\frac{D_0^2}{4} - x^2}.$$

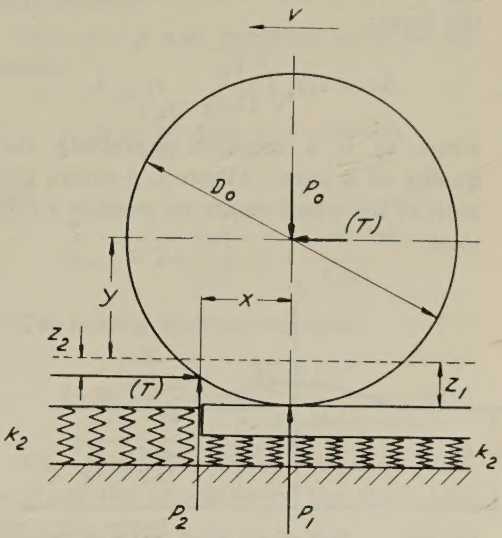


Fig. 6*a*. — Wheel at rail joint.

The wheel centre moves horizontally up to the point $x = x_0$ for $z_1 = \frac{P_0}{k_2}$ and $z_2 = 0$ if we neglect the increased deflection towards the rail end. At this point the wheel receives an impulse (blow) and Δv can be determined:

$$\Delta v = v \left(\frac{dy}{dx}\right)_{x = x_0} = (-)\, v \frac{x_0}{\sqrt{D_0^2 - 4\,x_0^2}}$$

x_0 can be determined:

$$x_0 = \sqrt{\frac{P_0}{k_2}\left(D_0 - \frac{P_0}{k_2}\right)}$$

Finally we obtain for Δv:

$$\Delta v = v \frac{\sqrt{\frac{P_0}{k_2}\left(D_0 - \frac{P_0}{k_2}\right)}}{D_0 - \frac{2\ P_0}{k_2}}$$

As 2 P_0/k_2 amounts to only between 1% and 0.1% of D_0 we can simply assume the form:

$$\Delta v = c_1 v \sqrt{\frac{P_0}{D_0 k_2}}; \quad c_1 \leqq 1,$$

where c_1 is a constant expressing the quality of a joint. Figure 6 *b* shows the path of the wheel centre on passing a rail joint.

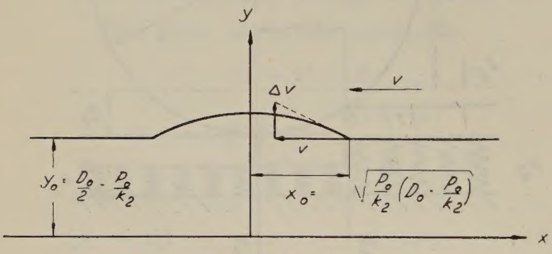

y
Δv
v
v
$y_0 = \frac{D_0}{2} - \frac{P_0}{k_2}$
$x_0 = \sqrt{\frac{P_0}{k_2}(D_0 - \frac{P_0}{k_2})}$
x

Fig. 6*b*. — Path of the wheel centre on passing a rail joint.

According to TIMOSHENKO (10), we can calculate the deflection of a beam end where the beam is supported over its whole length on a continuous elastic foundation as:

$$z = -\frac{P_0\sqrt{2}}{\sqrt[4]{EJk^3}} \approx \frac{P_0}{k_2}, \tag{4}$$

where E is the modulus of elasticity of the rail, J its moment of inertia and k the support constant (kp/mm²). From this k_2 can be determined as:

$$k_2 = \sqrt[4]{\frac{EJk^3}{4}}. \tag{5}$$

Thus, the relative vertical addition becomes according to (3), (4) and (5):

$$\varphi_1 = v \frac{k_{12}}{\sqrt{P_0 D_0}} \cdot \frac{1}{p_1} \cdot \frac{c_1}{\sqrt[8]{\frac{EJk^3}{4}}}. \tag{6}$$

The approximations used hitherto have not caused any appreciable inaccuracies, but to make equation (6) usable we must resort to more extensive simplifications. Earlier on we have obtained for p_1:

$$p_1^2 = \frac{\omega_1^2 + \omega_2^2}{2}$$

$$+ \sqrt{\left(\frac{\omega_1^2 - \omega_2^2}{2}\right)^2 + \mu_1^2\mu_2^2} \tag{7}$$

As this expression is unwieldy, we can suitably substitute with:

$$p_1^2 = \mu_1^2 + \mu_2^2 = k_{12}\frac{m_1 + m_2}{m_1 m_2} \tag{8}$$

The value of p_1 according to equation (8) is seldom as much as 5% less than the value for p_1 according to equation (7) and the difference is under no condition more than 10%.

As the approximation thus obtained is always lower than the theoretical value, φ_1 is calculated on the safe side.

Finally we put:

$$\varphi_1 = v \frac{k_{12}}{\sqrt{P_0 D_0\left(\frac{1}{m_1} + \frac{1}{m_2}\right)}} \cdot \frac{c_1}{\sqrt[8]{\frac{EJk^3}{4}}} \tag{9}$$

The wheel set is in the meantime also acted upon by other dynamic forces in the vertical direction. Unevenness of the track causes low frequency oscillations of the car which are mainly determined by the mass and springing of the car. Thus, contrary to the oscillations calculated above, they are not limited to act within the wheel set.

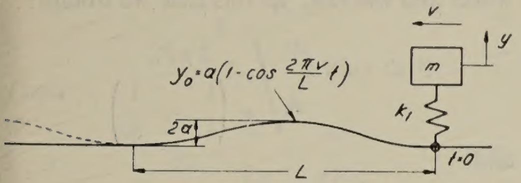


Fig. 7. — Vertical irregularity of the track.

We assume that the track deviates in the vertical direction from the straight line as shown in figure 7. If m denotes the mass of the car and k_1 its springing, we can draw up the equation for the oscillation system as given below. We can quite safely disregard rail and wheel set springing, expressed by k_{12} and k_2 and obtain:

$$\ddot{y} + y\omega^2 = a\omega^2 (1 - \cos pt)$$

where

$$\omega^2 = \frac{k_1}{m} \quad \text{and} \quad p = \frac{2\ \pi v}{L}$$

This is the differential equation of a system acted upon by periodic oscillation and has been treated thoroughly by TIMOSHENKO (¹¹). With the start conditions of $y = \dot{y} = 0$ at $t = 0$ the solution for the compression of the spring is found:

$$y - y_0 = y_1 = a \frac{p^2}{p^2 - \omega^2}$$

$$(\cos pt - \cos \omega t)$$

A resonance arises when $\omega = p$ with the amplitude:

$$y_1 = a \frac{pt}{2} \text{ at } t = \frac{\pi}{2\ p} (2\ n - 1).$$

The only amplitude limit consists of spring damping. Very strong oscillations appear, which in practice has occurred with sleeping cars equipped with SJ bogies model 42. These bogies were equipped with undamped helical springs, the oscillations disappearing when dampers were fitted.

For $\omega > p$ and therefore $\omega^2 \gg p^2$ we obtain:

$$y_1 \approx a \left(\frac{p}{\omega}\right)^2 (\cos pt - \cos \omega t)$$

and

$$y_{1max} \approx 2\ a \left(\frac{p}{\omega}\right)^2 = a \frac{8\ \pi^2 v^2 m}{L^2 k_1}$$

The *relative* addition becomes:

$$\varphi_2 \approx \frac{y_{1max}\, k_1}{m} = \frac{8\ \pi^2}{g} \left(\frac{v}{L}\right)^2 a. \quad (10)$$

The relative addition depends thus only on the condition of the track and the train speed.

For $\omega < p$ and $\omega^2 \ll p^2$ we obtain:

$$y_1 \approx a\ (\cos pt - \cos \omega t)$$

and

$$y_{1\ max} \approx 2\, a.$$

As this case occurs only rarely and then gives rise to very small forces, we can neglect it at present. It forms to a certain extent a transition to the rail joint blow, the effect of which is expressed in equation (9).

The case characterized by $\omega > p$ is certainly of primary interest, as the other cases are of little importance with present train speeds and design practice.

The dynamic flange force.

The flange pressure occurs due to the side-to-side movement between the two rails (sinusoidal movement) and at the start and end of curves, etc. The bibliography (12) (13) (14) shows very thorough investigations of these movements and DAUNER and HILLER (12) deduce an expression for the pure flange blow (Anlaufstoss), which, without considering transverse frictional forces, may be written:

$$P_{m\,max} = v \sin \alpha \sqrt{m_{red}\, k_{red}},$$

where v is the train speed, α the angle between the track and the direction of movement of the wheel when the flange hits the side of the rail, m_{red} the mass of the car reduced to the point of impact and k_{red} the spring constant for the system in the transverse direction.

A linear factor depending on the speed appears also here in the same way as in the vertical addition for rail blows. The mass m_{red} can according to DAUNER and HILLER be expressed as:

$$m_{red} = \frac{m}{1 + \frac{d^2}{\rho_d^2} + \frac{h^2}{\rho_h^2}},$$

where m is the total mass of the car, d the horizontal distance between the point of impact and the centre of gravity of the car, ρ_d the radius of gyration for the vertical axis through the centre of gravity of the car, h the height of the centre of gravity and ρ_h the radius of gyration for the longitudinal horizontal axis through the centre of gravity of the car. This should be correct for cars carried on two axles and whose axle boxes are hard sprung against the car as well as for bogie cars and locomotives where the body bolster is carried on sliding surfaces, which must be considered rigid during impact. In this case we can obviously put :

$$m_{red} \propto 2\,n \frac{P_0}{g},$$

where n is the number of wheel sets and we can further assume that k_{red} depends only on the transverse springing of the wheel and the rail. In this case we obtain:

$$F \propto v \sin \alpha \sqrt{\frac{2\,n P_0}{g\left(\frac{1}{k_s} + \frac{1}{k_r}\right)}}$$

and

$$\psi_1 = \frac{F}{P_0} \propto \frac{v \sin \alpha}{\sqrt{\frac{P_0 g}{hn}\left(\frac{1}{k_s} + \frac{1}{k_r}\right)}}$$

or

$$\psi_1 = \frac{c_2 v}{\sqrt{\frac{P_0}{n}\left(\frac{1}{k_s} + \frac{1}{k_r}\right)}}, \qquad (11)$$

where c_2 is a constant including $\sqrt{\frac{2}{g}}$ and $\sin \alpha$, and has the dimensions $[L^{-\frac{1}{2}} t]$. This constant can be determined only by measurements.

The term $1 + \frac{d^2}{\rho_d^2} + \frac{h^2}{\rho_h^2}$ has been neglected purposely as in a first approximation we may assume that it is not of the same importance as the other factors and it also can be rather difficult to determine the radii of gyration.

One can hardly put m_{red} proportional to the whole mass of the car for bogie cars with link suspension. In this case m_{red} should correspond to the total weight of the bogie (including wheel sets). ψ_1 should therefore have the form:

$$\psi_1 = \frac{c_2 v}{P_0} \sqrt{\frac{m_{red}}{\frac{1}{k_s} + \frac{1}{k_r}}}, \qquad (11a)$$

where m_{red} is proportional to the weight of the bogie.

The purely centrifugal force can be determined as:

$$F = \frac{P_0 v^2}{gR}$$

and

$$\psi_2 = \frac{F}{P_0} = \frac{v^2}{gR}, \qquad (12)$$

where R is the radius of the curve.

Summary of the dynamic forces.

We have obtained the following expressions for the dynamic forces occurring between wheel and rail:

$$\varphi_1 = v \sqrt{\frac{k_{12}}{P_0 D_0 \left(\frac{1}{m_1} + \frac{1}{m_2}\right)}} \cdot \frac{c_1}{\sqrt[8]{EJ\frac{k^3}{4}}} \qquad (9)$$

$$\varphi_2 = \frac{8 \; \pi^2}{g} \left(\frac{v}{L}\right)^2 a \qquad (10)$$

$$\psi_1 = \frac{c_2 v}{\sqrt{\frac{P_0}{n}\left(\frac{1}{k_s} + \frac{1}{k_r}\right)}} \qquad (11)$$

$$\psi_2 = \frac{v^2}{gR} \qquad (12)$$

and we have $P = P_0 \; (\varphi_1 + \varphi_2)$ and $F = P_0 \; (\psi_1 + \psi_2)$.

The results of the measurements will show in the following that φ_2 and ψ_2 may be neglected in dimensioning wheel sets and it can also be shown purely theoretically that φ_2 is approximately 1/5 of φ_1. If we again consider the normal Swedish wheel set SJ type 21 for a guard's van with a speed of $v = 25$ m/sec. (82 ft./sec.) and $k_2 \approx 3\,000$ kp/mm (16 800 lb./in.), we obtain for $P_0 = 8\,000$ kp (17 600 lb.) and $c_1 = 0.5$:

$$\varphi_1 = 1.35$$

which shows that the rail blow can produce an additional dynamic stress in the axle which is 1.35 times greater than the static stress. That this is well in agreement with the measurements will be shown further on.

Assuming an unevenness of the rail $2a \approx 10$ mm (0.4 in.) on a length $L \approx 10$ m (3.3 ft.), we obtain further:

$$\varphi_2 = \frac{8 \; \pi^2}{g} \left(\frac{25}{10}\right)^2 0.005 = 0.25$$

or obviously barely 20% of φ_1.

φ_1 becomes therefore the deciding factor for the dimensioning of wheel sets, whilst the dimensioning of the car springs will depend on φ_2. Can, on the other hand, better joints be obtained or can these be practically eliminated, then φ_2 will be the deciding factor also for the wheel set. Wheel set dimensions could, presumably, be considerably reduced in this case.

Similarly ψ_2 is substantially less than ψ_1 for the flange force F, depending partly also on the raising of one rail in curves which to quite a large extent is accompanied by a lowering of ψ_2. ψ_2 should lie between 0.1 and 0.2 whilst ψ_1 lies between 0.5 and 1.5.

The deduced equations are first and foremost to be considered as proportionality equations. They show primarily which are the deciding factors for the play of forces between wheel set and rail, but can to a certain extent also be used to estimate the magnitude of the forces acting. In connection to that said earlier regarding probability distribution of the forces, c_1 and c_2 may also be regarded as distribution functions for the dynamic forces.

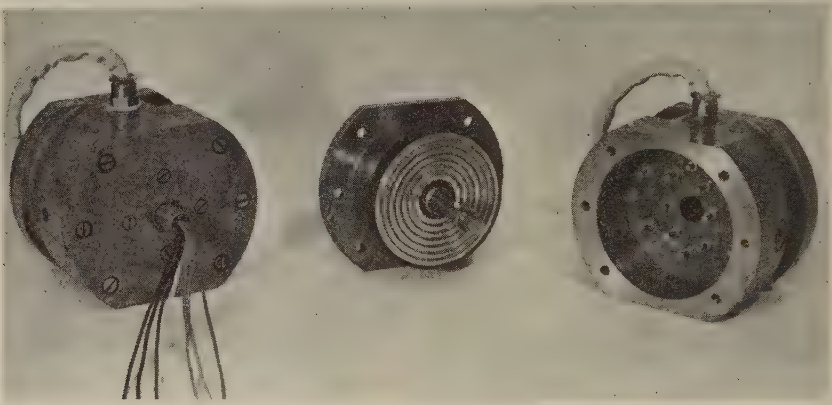


Fig. 8. — Slipring assembly.

The measurement of stresses on wheel sets under service conditions and a comparison with the theoretical results.

Surahammars Bruks A.B. established contact with the Royal Railway Board in 1947 in order to enable a comprehensive investigation to be made of wheel sets with regard to both manufacturing and dimensioning. These investigations have been in progress since then, partly material tests and model tests and partly tests under operational conditions. The Central Laboratory of Asea has been in charge of the operational tests and evolved the measuring apparatus and methods. An account of the measuring and the results thus obtained is given below. These measured results are also compared with the theories evolved above parallel with the account.

Measuring apparatus and methods.

The resistance strain gauges developed during the war were used to measure the actual stresses in wheel sets. The transmission of the measuring currents from the rotating axle to the car body and the registering of the measured stresses provided some difficulties to be overcome. The current was transmitted by a slipring assembly with silver sliprings and silver brushes suspended under the car body outside the axle boxes of the wheel set to be investigated. The assembly was

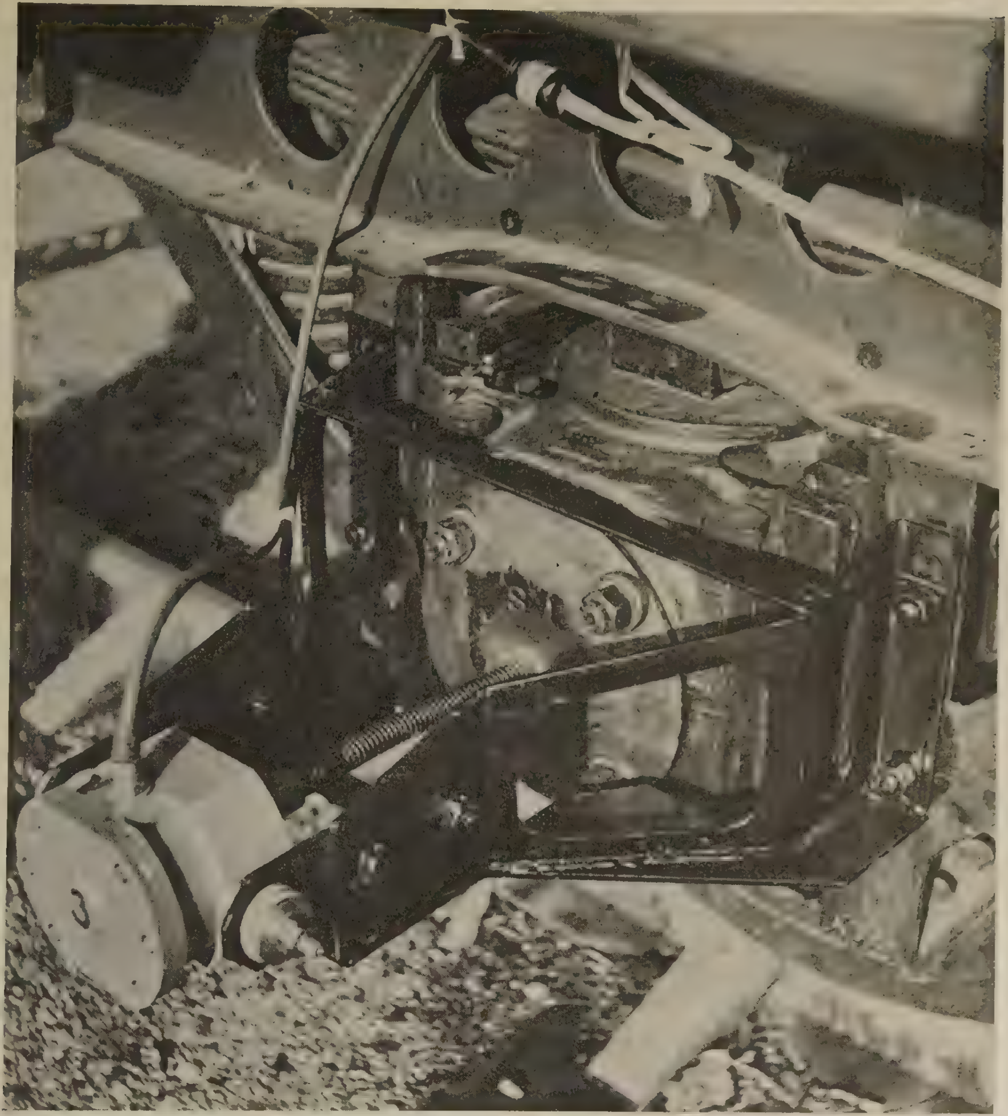


Fig. 9. — Slipring assembly suspended on the bogie frame.

placed so that its axis of rotation coincided with that of the wheel set. The final form of the slipring assembly is shown in figure 8. The rotor axle is hollow to permit the cables to be taken through it and the journal stub of the wheel set is provided with a corresponding hole, which through a radial hole opens out inside the wheel web. The journal stub and the slipring assembly were connected by a spiral tube, which was torsion stiff but stretchable and bendable. This allowed the wheel set to move relative to the slipring assembly without damaging or shaking it. Four of these assemblies have been in operation and the transmission has, since certain small faults were adjusted, worked well even under difficult climatic conditions. Measurements were carried out on cars as well as electrical locomotives and figure 9 shows a slipring assembly suspended in the bogie frame of a four-axle bogie car. As the measurements were carried out nearly exclusively on electrified lines, it was of great importance to screen the measuring apparatus. It was even possible to carry out measurement free of disturbance on electrical locomotives and unsolvable disturbance problems have never appeared.

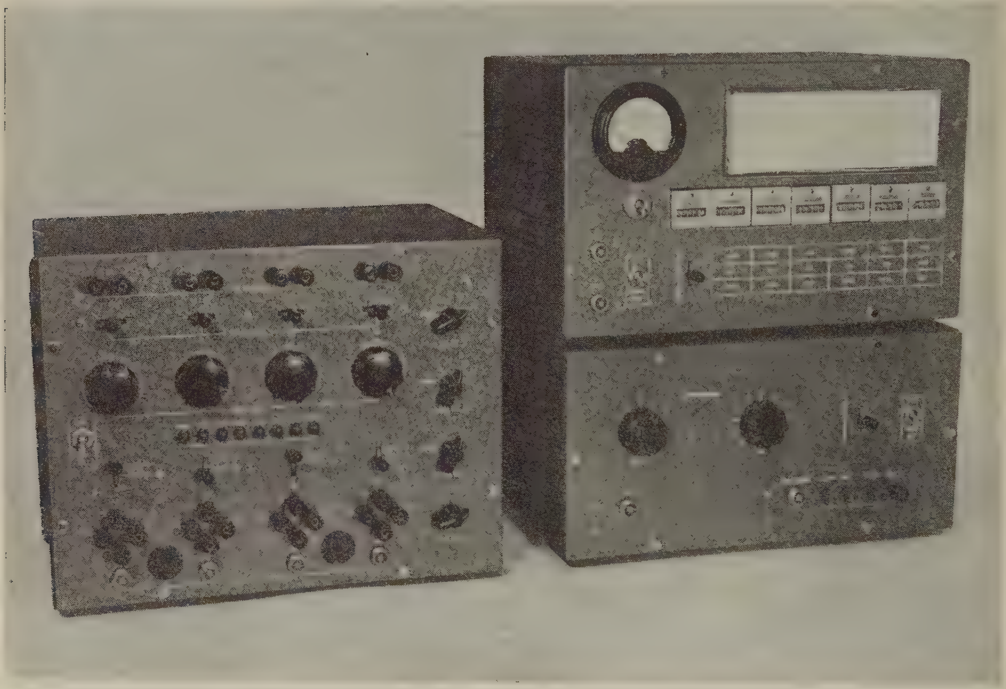


Fig. 10. — *Left :* Balancing and calibrating unit. *Right :* Impulse counter and amplifier.

It was clear already at the beginning that a continual registering of the measured stresses over longer distances was not practicable. A registering instrument based on a counting relay was therefore evolved. This consists in principle of a number of channels each of which contains a relay valve (thyratron) acting on a counting relay. The relay valves can be adjusted to ignite and act on the counting relay at a tension level determined in advance. In this way an impulse is obtained when the tension, i.e. the stress in the axle, exceeds the level determined for each relay. The probability distribution of the stresses as a function of the number of wheel revolutions was thus obtained directly with the aid of such impulse counters, each with seven channels.

The equipment consisted, apart from two impulse counters, of a bridge unit for balancing and calibrating four measuring points as well as two amplifiers. It was thus possible to have four measuring points coupled in and balanced and carry out simultaneous measurements on two of them. This measuring equipment is shown in figure 10. Apart from this an oscilloscope was always used to control the measurements. Such control was carried out for every measurement practically continually.

Three different measurements were taken in principle: the total stress on a point of the axle, the total stress on a point of the wheel and by a special coupling the stress in the axle resulting only from the flange force F. Five different types of wheel sets have now been investigated under a two-axled guard's van, under a four-axled bogie locomotive and under a four-axled bogie rail bus.

Results of measurements.

The probability distribution for the dynamic stresses obtained from the measurements may suitably be represented in the way shown in figure 11. The probability W for the stress in the point of investigation exceeding a given value during one revolution of the wheel set can be determined from the diagram. Figure 11 shows six series of measurements of approximately 50 000 revolutions each for the stress in the wheel seat fillet for a wheel set SJ type 21. The static journal force was 7 000 kp (15 400 lb.), the wheel set belonging to a two-axled guard's van. The measurements were undertaken on the 5.-9. June 1950 on the ordinary passenger train on the lines Stockholm-Malmö-Gothenburg-Stockholm. The maximum train speed was approximately 90-100 km/h (60 m.p.h.).

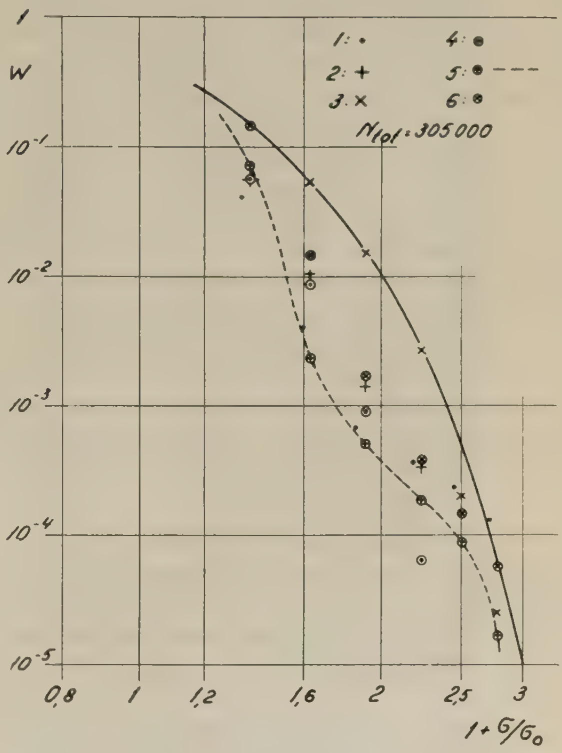


Fig. 11. — Stress at the wheel seat fillet for SJ type 21.

As expected, the curves for the six series did not coincide and an area of spreading was obtained, this depending on the external conditions for each measurement. The series 1-3 were taken on the first wheel set relative to the direction of travel and the series 4-6 with the wheel set last. It can be observed that to a certain extent the stresses are greater for the first wheel set. This is especially noticeable in series 3, which was also taken on a worse line than the others from a qualitative point of view. An other peculiarity noticeable on many series is the deformation in the distribution curve occurring between $W = 10^{-2} - 10^{-3}$ for series 5 in figure 11. This special feature points to a composition of two probability distributions rather different to each other, this occurring more often when the wheel set travels first relative to the direction of motion. This concerns probably the following components: rail joint blows, sinusoidal travel and vertical unevenness of the rail which occur often but cause lower stresses; braking, switches and curve entrances and exits which occur rather less often but may cause high stresses.

A good proof of this was obtained when measuring on the line Lund-Arlöv (Malmö) on the 14.-16. December 1948, where measurements were carried out partly on the first and partly on the last wheel set of a two-axled guard's van. The line through the shunting yards at Malmö was not clear on entering Arlöv, hard braking therefore occurring often. The first wheel set was thus subject to great additional brake forces whilst the last wheel set became to a certain extent unloaded. Figure 12 shows both occurrences, the stresses in this case being measured in the middle of the axle.

Even if we can obtain interesting detail information in this way, in order to form a general opinion of the loading of wheel sets and the serviceableness of the theories we are served better by the mean distribution of different series for the same point of measurement. These series must therefore be compiled for good as well as bad tracks in order to be representative for a given trafic area. A great number of tests has shown that a very good reproduceability can be obtained by the repetition of tests on the same track with as little variation in the external conditions as possible. Are the tests carried out on different tracks the probability distribution shows certain discrepancies.

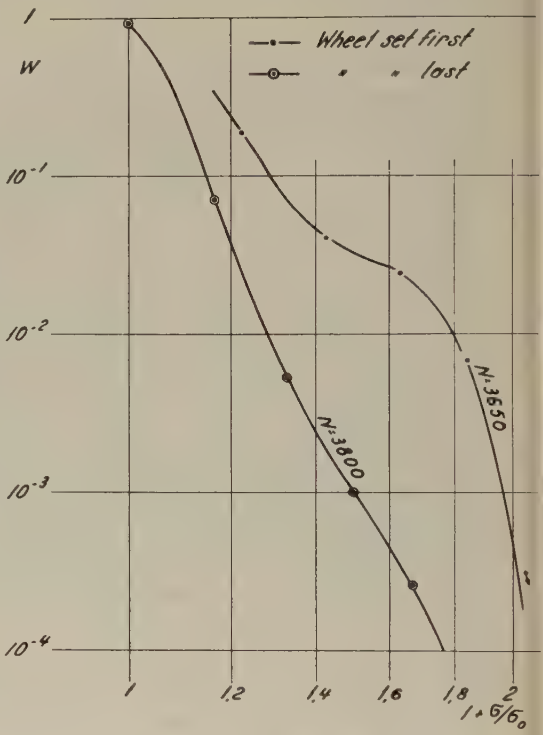


Fig. 12. — Stress at the middle section of the axle body portion for SJ type 21.

These are, however, limited to the extent that the upper stress limit curve (full line in figure 11) for a number of series has never exceeded the mean curve more than 15% with the measurements carried out to date. The difference has in a few cases been only 5%, but mostly about 10%. We shall only consider the mean values of the probability distribution below, whereby the total number of wheel revolutions will always be given.

The stress distribution has been measured mostly at the wheel seat fillet inside the wheel. Some measurements have been carried out on the same axle but with two different static journal forces P_0. As φ_1 as well as ψ_1 are dependent upon $\frac{1}{\sqrt{P_0}}$ we should be able to notice an increase in the stress addition for lower static journal forces. Figure 13 shows the two probability distributions as a function of $1 + \frac{\sigma}{\sigma_0}$, where σ is the stress addition at the wheel seat fillet.

Both tests have been carried out with wheel sets SJ type 21, one with $P_0 =$ 7 000 kp (15 400 lb.) over approximately 300 000 wheel revolutions and the other with $P_0 =$ 4 950 kp (10 900 lb.) over approximately 85 000 wheel revolutions. These tests were carried out on parts of the lines Stockholm-Malmö-Gothenburg-Stockholm with a maximum train speed of approximately 90 km/h (56 m.p.h.) with the wheel sets going both first and last relative to the direction of travel.

We can expect that the stress additions will have the ratio of $\sqrt{\frac{4\,950}{7\,000}} = 0.84$, where the stress addition for $P_0 = 7\,000$ should be the smaller of the two. The measurements, according to figure 13, give between $W = 10^{-1}$ and $W = 10^{-3}$ a ratio for the stress addition σ of 0.81 to 0.89. The agreement is good in this case.

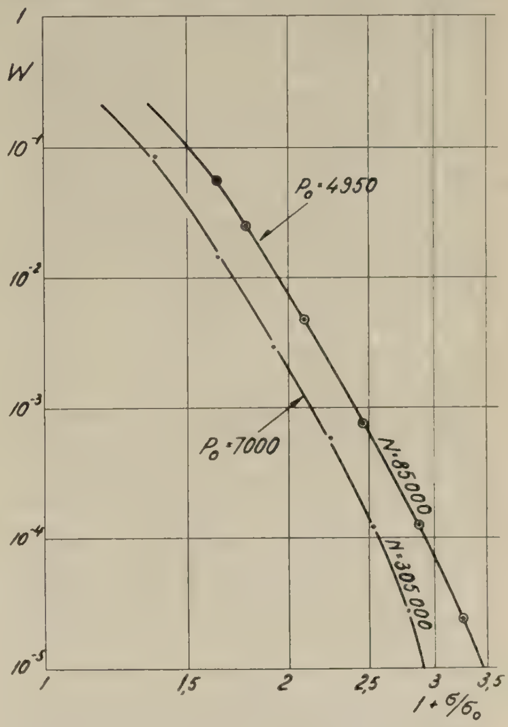
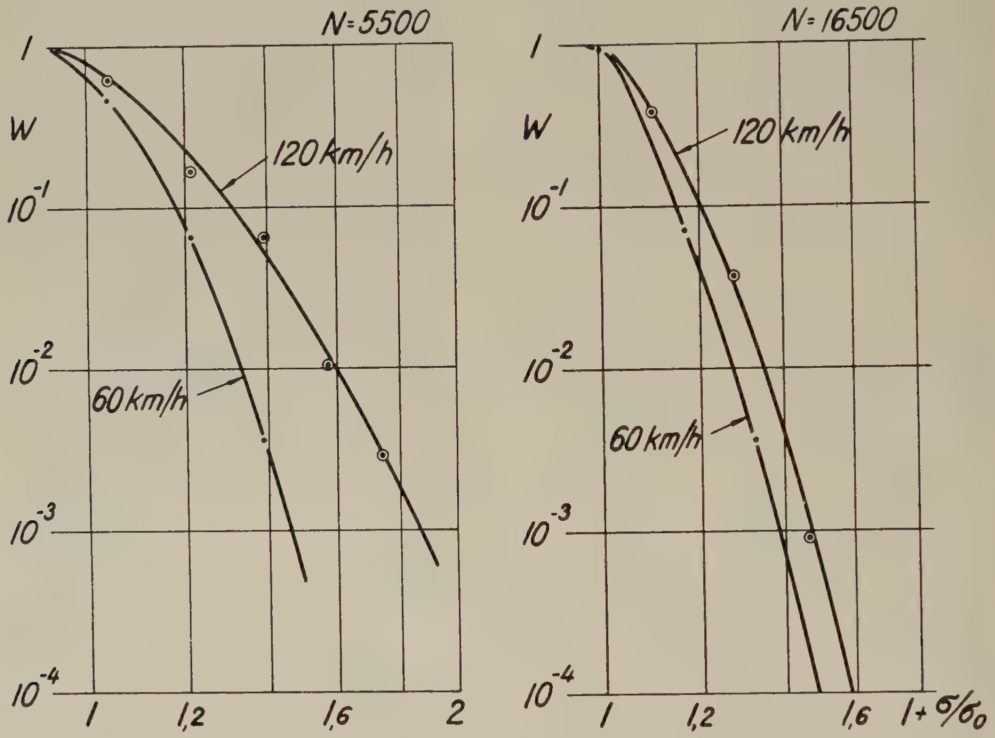


Fig. 13. — Stress at the wheel seat fillet SJ type 21.

An other factor which can be controlled by the stress addition in the axle is the influence of speed. As both φ_1 and ψ_1 should be proportional to the speed v, we can investigate how this agrees with a number of tests carried out on the line Eslöv-Hässleholm. The stress measurements were taken on two different axles, on exactly the same track, in the middle of the axle in order to obtain equivalence with regard to the flange forces from both wheels. The results are shown in figures 14*a*, and 14*b*. It can be seen that agreement is very good in one case, but not so good in the other. These two examples form the extreme cases for six series of tests, which were, however, carried out on distances too short to give a sufficiently sure basis for judgement.

Comparison of the stress distribution for the wheel seat and for the axle box spring shows clearly that the additions due to the low frequency movements of the car body are much more moderate than the additions occurring in the axle. Figure 15 shows such a comparison for a bogie car and it is clear that φ_2 and ψ_2 play a very small part in the total addition for the axle, especially for $W < 10^{-2}$. The ratio between the stress additions in the spring and those in the wheel seat are approximately 0.2 between $W = 10^{-2}$ and $W = 10^{-4}$.



Figs. 14*a* and *b*. — Axle stresses at various speeds.

The flange force has been investigated on three different occasions. One test was carried out on the four-axled dynamometer car of the Railway Board on various tracks in southern Sweden in November 1949 with one wheel set SJ type 21 and one light weight hollow axle wheel set placed in the same bogie. The wheels of SJ's type 21 had a spring constant $k_s \approx 6\,700$ kp/mm (375 000 lb./in.) in the direction of its axis and the wheels of the hollow axle wheel set had a spring constant $k_s \approx 1\,200$ kp/mm (67 000 lb./in.), both values having been determined by measurement. The ratio of the flange forces for both these wheel sets was 1.2 over practically the whole of the probability range, the smaller flange force being that for the hollow axle wheel set. The ratio for ψ_1 of these two wheel sets becomes on inserting the values for the spring constants k_s and $k_r = 1\,000$ kp/mm (56 000 lb./in.) in equation (11):

$$\sqrt{\frac{\dfrac{1}{1\,000} + \dfrac{1}{1\,200}}{\dfrac{1}{1\,000} + \dfrac{1}{6\,700}}} = 1.26,$$

which is an acceptable agreement, the value $k_r = 1\,000$ kp/mm being the mean value of various figures given in the technical litterature for the lateral springing of a rail.

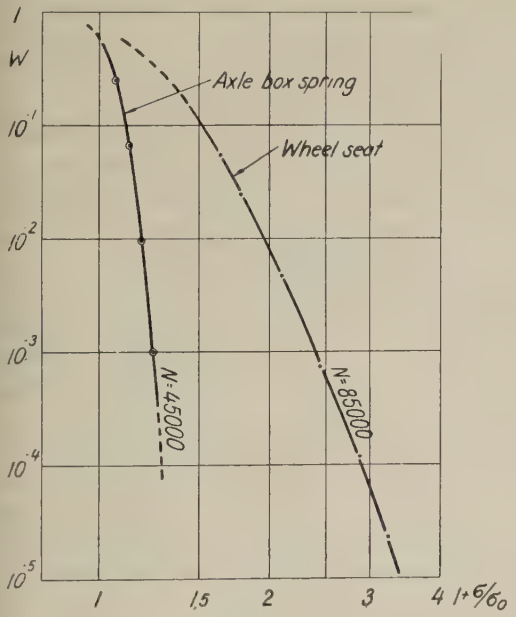


Fig. 15. — Comparison between the dynamic stresses in the wheel seat fillet and the axle box spring. $P_0 = 4\,950$ kp.

An other test was carried out on the same tracks with a two-axled guard's van in June 1950, the purpose of which was to compare a special hollow axle with SJ's type 21. The hollow axle wheel set was fitted with wheels having rubber pads under the rim of the wheel centre. Due to this a strong lateral springing was obtained whilst the wheels were almost stiffer radially than the wheels of SJ's type 21. The rubber pad movement was limited by metal to metal contact at a 3-4 mm (0.12″-0.16″) displacement of the tyre and as the measured spring constant k_s was 500 kp/mm (28 000 lb./in.), this limiting corresponds to a flange force of approximately 1 500-2 000 kp (3 300-4 400 lb.). The flange force distribution for the two wheel sets is shown in figure 16, the curve for the special wheel having a strong deflection in the range $\frac{F}{P_0} = 0.15$ to 0.2. As P_0 was 7 000 kp (15 400 lb.) this corresponds to a flange force between 1 000 and 1 500 kp (2 200 and 3 300 lb.) or somewhat less than the force obtained for the maximum deflection of the rubber pads. These flange forces were obtained by measuring the stresses in the wheel and as the calibration for the special wheel set was rather difficult, it is possible that the values obtained in the tests were a little low. If we imagine the upper part of the lateral force distribution and extended curve according to the dotted line, we obtain a flange force ratio of approximately 2 for the two wheel sets in the range W $= 10^{-2}$ to 10^{-4}. The ratio of ψ_1 for SJ's type 21 and for the special wheel set becomes with the figures for k_s and $k_r = 1\,000$ kp/mm inserted in equation (11):

$$\sqrt{\frac{\frac{1}{1\,000}+\frac{1}{500}}{\frac{1}{1\,000}+\frac{1}{6\,700}}} = 1.6.$$

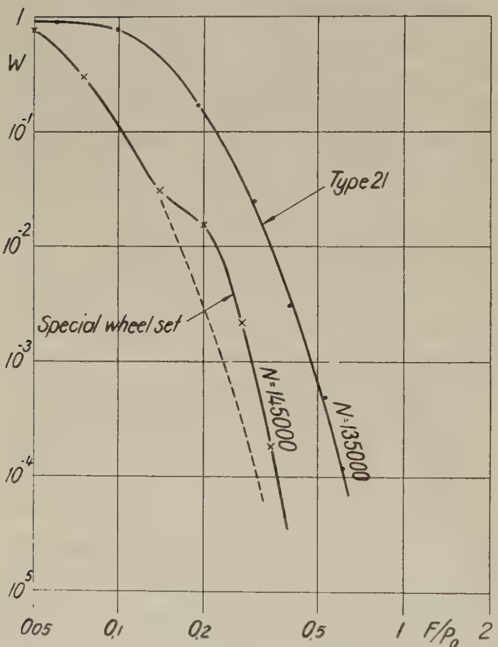


Fig. 16. — Flange forces for car with two axles.

The tests gave a higher ratio, but this may be due to the above mentioned calibration difficulties.

The third test was carried out on the main line of North Sweden between Ånge and Boden in January and February 1952. In this case two driven wheel sets of a locomotive (type M) with two three-axled bogies were compared. One wheel set had the normal type of bearings whilst the other had thrust springs fitted at the axle boxes. The lateral movement was limited by metal to metal contact at 4 mm (0.16″) with a force of 4 500 kp (10 000 lb.), this giving a spring constant of 1 125 kp/mm (63 000 lb./in.). The static force P_0 was 7 900 kp (15 800 lb.), the distribution of the flange forces being shown in figure 17. A deflection of the distribution curve can also be observed in this case for the wheel set fitted with axial springs. On extending this curve with the dotted line a ratio for F of approximately 1.25 is obtained and as the spring constant k_s of the wheel is greater than 30 000 kp/mm (1 680 000

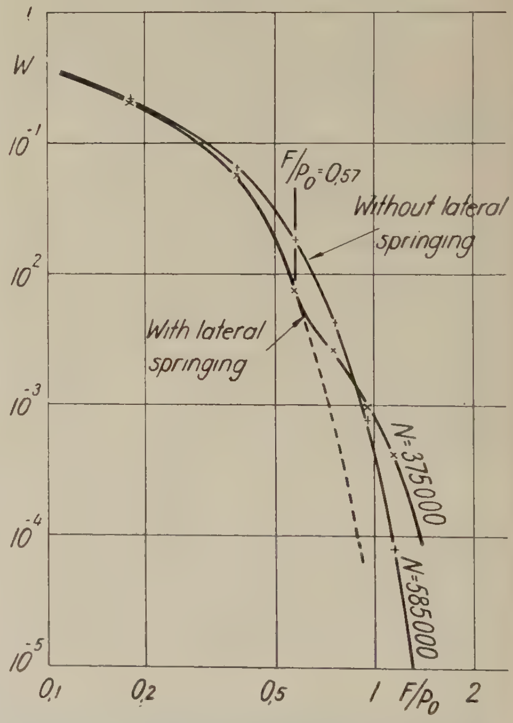


Fig. 17. — Flange force distribution for wheel set for bogie locomotive. $P_0 = 7\,900$ kp.

lb./in.) we can determine the ratio of ψ_1 for both wheel sets as:

$$\sqrt{\frac{\frac{1}{1\,000}+\frac{1}{1\,125}+\frac{1}{30\,000}}{\frac{1}{1\,000}+\frac{1}{30\,000}}} = 1.36.$$

This may be considered as a rather good agreement. From figure 17 we can see also that the metal to metal value $\frac{F}{P_0} = \frac{4\,500}{7\,900} = 0.57$ coincides well with the deflection of the curve. The same deflection occurred also in the stress distribution curve for the wheel seat fillet. It is therefore obvious that metal to metal contact is obtained relatively often with the thrust springs and that the lateral forces occurring at these instants slightly exceed the values obtained with the unsprung arrangement. This may be considered as reasonable, as the masses in movement have a certain kinetic energy before metal to metal contact occurs and the dissipation of this results in an impact force in excess of the value obtained with the unsprung arrangement.

It has to date only been possible to measure the total stress as well as a part of the stress due to only flange forces and it is therefore difficult to obtain a comparison between measurement and theory for the vertical forces.

A number of tests will be undertaken in 1953 in which also the vertical forces will be measured separately. According to the results obtained to date there is nothing that speaks against the theories evolved for the vertical forces. That φ_2 can be neglected in a first approximation in comparison with φ_1 must be considered confirmed and it has further been proved that φ_1 with a good approximation is proportional to $\frac{1}{\sqrt{P_0}}$. The effect of speed is not quite clear yet, a proportionality between v and φ_1 seems to exist in certain cases.

The mass of the wheel set should play a smaller part than the springing of the wheel set k_{12} according to equation (9). A comparison between wheel set SJ type 21 and a light weight wheel set with a hollow axle and specially thin wheel webs, which as mentioned earlier on has been tested under a bogie car, is given below :

WHEEL SET	P_0	k_{12}	m_1	m_2	$\frac{\varphi_1\sqrt{k_{12}}}{c_1 v}$
SJ type 21	4 950	14 000	250	1 000	7.5
Light weight	5 100	15 800	230	750	7.3

Thus appreciable differences in the vertical forces should not occur. The stress distribution curves for the wheel seat fillet were also drawn up for the above mentioned tests, shown in figure 18. The ratio of the dynamic stresses for the two wheel sets is approximately 1.1 to 1.25 for the range W = 10^{-2} to 10^{-4}. It has been said earlier that the ratio of the flange forces for these wheel sets was approximately 1.2 according to measurements. As the stress in the wheel seat fillet depends to a large extent on the flange force, the difference between the dynamic vertical forces should not be great. The theoretical ratio according to the above table is only $\frac{7.5}{7.3} = 1.03$.

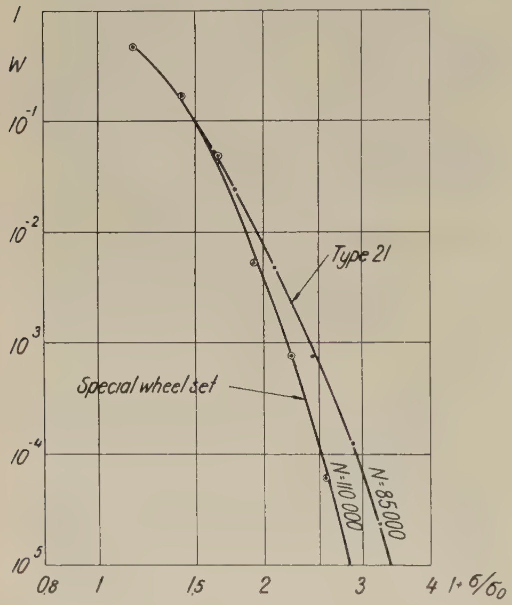


Fig. 18. — Stress in the wheel seat fillet for type 21 and a hollow axle wheel set. $P_0 \approx$ 5 000 kp.

The stress distribution for the journal stub of a driven rail bus axle was measured during the summer of 1952. This axle was fitted with a brake drum placed outside the axle box and as cracks were discovered in the journal stub already after a short operational life it was considered necessary to undertake operational tests in order to obtain a basis for alterations of the axle. A stress distribution as shown in figure 19 was obtained, the journal load normally not exceeding 2 700 kp (5 940 lb.). The nominal stress σ_0 for this was 3.1 kp/mm^2 (1.97 T./in.^{2}) at the journal stub fillet. The journal load could, however, exceed 2 700 kp with unsymmetrical loading of the car, on one journal stub P_0 was measured to be approximately 3 000 kp (6 600 lb.).

It had been assumed, before these tests had been carried out, that the brake drum outside the axle box influenced the resonance vibrations of the wheel set partly by increasing the mass m_1 (axle box + journal stub) and partly by increasing the distance between the wheel and the

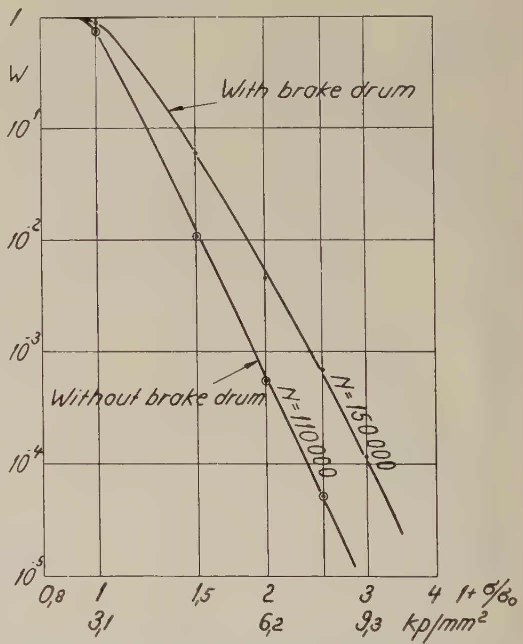


Fig. 19. — Stresses in the axle stub of driven wheel set on rail bus. $P_0 \approx$ 2 700 kp.

centre of gravity for m_1. The stresses were therefore also measured on a journal stub with the brake drum removed, this being therefore correspondingly shorter. The stress distribution thus obtained is included in figure 19.

It was shown that the assumption was correct, the brake drum had obviously increased the dynamic stresses by 55%. By placing the brake drums inside the wheels a decrease of the dynamic forces and therefore an increase in the operational life of the axle can be obtained. This increase was estimated conservatively to three times the present length of life but should in reality be greater, perhaps five to ten times.

The tests carried out to date have clearly shown that the resonance theories submitted in this paper should not be disregarded. Future tests will be arranged so that they will contribute to the solving of this question.

A suggestion for the calculation of the dynamic forces acting on a wheel set.

It would be interesting to see if we can work out a sufficiently reliable and simple way of calculating the forces and stresses occurring in a wheel set on the basis of the material presented in this paper.

As the expressions evolved for the dynamic forces seem on the whole to agree with the measurements taken, the suggestions given below will be based on the additions φ_1 and ψ_1 according to equations (9) and (11). Whether equation (11*a*) must be used in certain cases can not be decided at this stage. We assume thus that the dynamic forces can be calculated as:

$$P = P_0 \varphi_1 \quad \text{and} \quad F = P_0 \psi_1$$

φ_2 and ψ_2 will only be considered in that the constants c_1 and c_2 will be determined from the results of the tests carried out. As mentioned earlier, φ_2 and ψ_2 are relatively small compared with φ_1 and ψ_1 and a number of safety margins will be included to eliminate any possible uncertainty on this point. The stresses σ_0, σ_P and σ_F for a given section of the wheel set can be determined by the help of the forces P_0, P and F.

The total stress can finally be determined as a function of these three stresses. This total stress σ_{tot} shall, in order to be the permitted working stress, be less than a fatigue strength depending on the material, surface finish and stress concentrations.

First we shall see how the track constants c_1 and c_2 may be determined. As the expression for φ_1 includes the rail springing k_2, it is naturally only possible to determine the value $\frac{c_1}{\sqrt{k_2}}$ from wheel set tests and as we have not yet carried out tests giving only the vertical force P, we are obliged to determine σ_P from the measurements of σ_{tot} and σ_F. As this is a question of the probability sum of two variables independent of each other, σ_P and σ_F, the determining of σ_P must be carried out according to the rules connected with this. Jarl KUUSINEN (15) gives a graphic method, which has been used in this case. The probability distribution for σ_p was thus obtained, enabling $\frac{c_1}{\sqrt{k_2}}$ to be determined after setting in the other values in equation (9). c_1 represents therefore the probability distribution of φ_1 and has been drawn in figure 20 as a function of $2 \times 10^6/W$. The reason for choosing this ordinate will be explained further on.

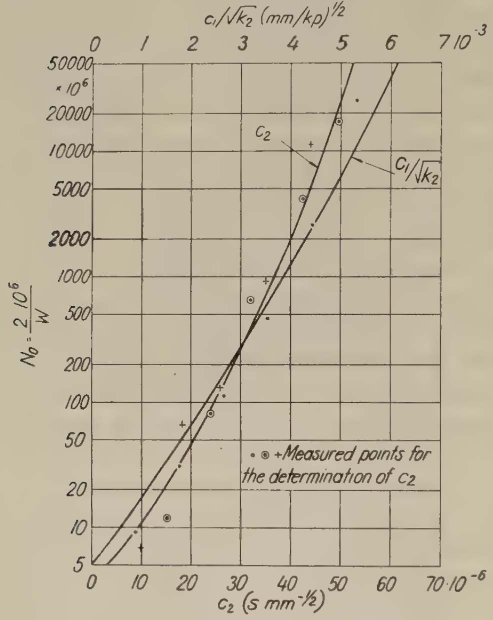


Fig. 20. — Track constants c_1 and c_2.

The constant c_2 can be determined directly from the measurements carried out for the flange force F, for which three series of measurements were taken. The values obtained with equation (11) were drawn in on figure 20 and as the agreement for the three different series (two different wheel sets under a guard's van and one wheel set under a bogie locomotive) is good, c_2 has also been drawn in.

This, however, lacks interest as long as we can not decide in a suitable way for which probability W c_1 and c_2 are to be chosen. We solve this difficulty by introducing the length of life of the wheel set N_0 revolutions. The stress distribution for a given section can thereby be converted and be represented as a function of the number of revolutions $N = N_0 \times W$. By choosing different N_0's, the probability distribution will be displaced as shown in figure 21. If we show the fatigue curve for the material (with consideration given to the surface finish and stress concentrations) in the same diagram as well, the fatigue curve will make a tangent to the stress distribution curve at a certain value of N_0. In this case the values of $N_0 = 2 \times 10^9$ and a tangent point of $N \approx 2.5 \times 10^6$ at $\sigma_{tot} \approx 9$ kp/mm² (5.7 T./in.²) were obtained according to figure 21. It has been found that the tangent point can vary between $N = 2 \times 10^6$ and 10^7, the latter value occurring for high stress concentration and bad finish as the form of a fatigue curve varies with these factors. In order to simplify calculations and to introduce a certain safety we can therefore decide that the actual length of life N_0 is obtained when the probability distribution of the stress goes through the point $N = 2 \times 10^6$ at a stress corresponding to the fatigue strength for $N > 10^7$, which can be denoted by σ_{u10}. This has been drawn in with dotted lines in figure 21. It can then be seen that $N \approx 10^9$ and a safety factor of 2 with regard to the length of life compared with the real tangent point is obtained. The ordinate in figure 20 has for this reason been chosen at $N_0 = 2 \times 10^6/W$. The method just described can only be applied if the stress distribution curve has a much smaller gradient than the fatigue curve.

This seems to be always the case, however, and as no better simple method for ascertaining the connection between fatigue and variable loading has appeared yet, we must accept this method. One can certainly carry out fatigue tests with stress cycles of varying amplitude which should give the best result, but this is very extensive, requiring special machines and taking a long time.

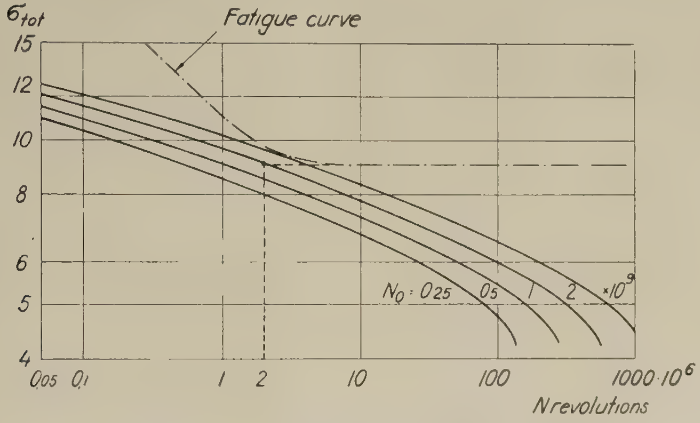


Fig. 21. — Determination of the length of life N_0.

As we can now determine σ_P and σ_F independent from each other and have a method for choosing N_0 and therefore W as well as c_1 and c_2, it remains to combine σ_0, σ_P and σ_F to σ_{tot}. We obtain a good result by representing the probability distribution for the two independent values

$$\left(1+\frac{\sigma_P}{\sigma_0}\right)=1+\varphi_1 \quad \text{and} \quad \frac{\sigma_F}{\sigma_0}=b\,\psi_1$$

as rather simple functions and their probability combination can then be determined either graphically or also analytically. The analytical method, which is simple to deduce and which is given by MAYR (16) has been used here and gives the following very simple approximate solution:

$$\sigma_{tot}=\sigma_0+\sigma_P+0.5\,\sigma_F.$$

This gives a close approximation for $\sigma_F \leq \sigma_0 + \sigma_P$ and $W < 10^{-1}$ or $N_0 > 20 \times 10^6$. Thereby is a certain safety also included as the partial unloading of certain parts of the wheel set due to the effect of the lateral forces (see figure 2*b*) has not been considered.

The final equations for the suggested method for wheel set calculations have the following forms:

$$\frac{P}{P_0}=\varphi=\frac{c_1 v}{\sqrt{k_2}}\sqrt{\frac{k_{12}}{P_0 D_0\left(\frac{1}{m_1}+\frac{1}{m_2}\right)}}, \qquad (9)$$

where

$$\frac{c_1}{\sqrt{k_2}}=\frac{c_1}{\sqrt[8]{EJk^3/4}},$$

which is obtained from figure 20 for the desired N_0 and:

$$\frac{F}{P_0}=\psi=\frac{c_2 v}{\sqrt{P_0\left(\frac{1}{k_r}+\frac{1}{k_s}\right)}}, \qquad (11)$$

where c_2 is obtained from figure 20 for the desired N_0.

σ_P and σ_F are furthermore determined from this, and we obtain:

$$\sigma_{tot} = \sigma_0 + \sigma_P + 0.5\ \sigma_F.$$

This value shall finally satisfy the condition:

$$\sigma_{tot} \times S = \sigma_{u10},$$

where S is a safety factor which primarily shall take into consideration that the stress distribution can exceed with 5-15% the mean value upon which we have based our data as well as the uncertainty which must exist due to various indeterminable factors. A suitable value for S would lie between 1.25 and 1.4, for example 1.3.

The curves for c_1 and c_2 are naturally approximate, but will be controlled and, if necessary, corrected with the help of future measurements. Furthermore, they can only be considered applicable to the Swedish railways, but it is not expected that great variation will occur if measurements are carried out in other countries. Finally it must be pointed out that the whole of this suggested calculation method is based on rails with butt joints, totally different conditions will be present in the case of jointless (welded joints) rails. The system of units used is the kp, mm and second system.

The theories, test results and suggested method of calculation are not claimed to be complete or final, but have been published at this stage to enable a wider circle to express their opinions of them.

BIBLIOGRAPHY

(1) Ziviling. Moritz WINKLER, Bochum: « Erfahrungen mit Hohlachsen bei Radsätzen der Schienenfahrzeuge », *Verkehr und Technik*, 2 (1949), No. 1, p. 11-13.

(2) Reichsbahnrat E. SPERLING, Göttingen : « Festigkeitsversuche an Eisenbahnwagen-Achsen als Grundlage für deren Berechnung », *Z. VDI*, 91 (1949), No. 6, p. 134-136.

(3) August WÖHLER : « Versuche über Biegung und Verdrehung von Eisenbahnwagen-Achsen während der Fahrt », *Zeitschr. f. Bauwesen*, 8 (1858), p. 641-652.

« Versuche über die einwirkenden Kräfte, etc., auf Eisenbahnwagen-Achsen », *Zeitschrift f. Bauwesen*, 10 (1860), p. 583-616. « Versuche über die Festigkeit der Eisenbahnwagen-Achsen », *Zeitschr. f. Bauwesen*, 13 (1863), p. 233-258.

« Versuche über die relative Festigkeit von Eisen, Stahl und Kupfer », *Zeitschr. f. Bauwesen*, 16 (1866), p. 67-84.

(4) Prof. Dr. BÄSELER, Offenbach/Main : « Zur wissenschaftlichen Weiterentwicklung des Oberbaues », *Verkehr und Technik*, 4 (1951), No. 8, p. 236-237.

(5) Dr. SALLER, Regensburg : « Einheitliche Berechnung des Eisenbahnoberbaues », *Org. f. d. Fortschr. d. Eisenbahnw.*, 87 (1932), No. 1, p. 14-19.

(6) Dr. A. WASIUTYNSKI, Warschau : « Ergebnisse von Versuchen der Polnischen Staatsbahnen über die federnden Formänderungen und die Beanspruchung des Oberbaues », *Monatsschrift der Intern. Eisenbahn-Kongr.-Ver.*, VIII (1937), No. 5, p. 1891-1895.

(7) Dr. A.N. TALBOT : « Beziehungen zwischen Fahrzeug und Gleis », *Monatsschrift der Internat. Eisenbahn-Kongr.-Ver.*, IX (1938), No. 1, p. 57-66.

(8) Dr. E. CZITARY, Wien : « Beitrag zur Berechnung des Querschwellenoberbaues », *Org. f. d. Fortschr. d. Eisenbahnw.*, 91 (1936), No. 8, p. 154-161.

(9) Ing. A.D. DE PATER : « Calculations for Beams of Infinite Length with Elastic Supports », *Monthly Bull. of the Int. Railway Congr. Ass.*, XXV (1948), No. 5, p. 265-285.

(10) Prof. S. TIMOSHENKO : « Strength of Materials », Part II, New York (1941).

(11) Prof. S. TIMOSHENKO : « Vibration Problems in Engineering », New York (1937).

(12) Dir. W. DAUNER und Reichsbahnrat E. HILLER : « Der Anlaufstoss bei Eisenbahnfahrzeugen », *Org. f. d. Fortschr. d. Eisenbahnw.*, 91 (1936), No. 7, p. 133-139.

(13) Dr. P. SCHÖNING, Berlin : « Das Schlingerproblem an Eisenbahnfahrzeugen », *Org. f. d. Fortschr. d. Eisenbahnw.*, 97 (1942), No. 15/16, p. 209-239; No. 17/18, p. 245-268.

(14) Prof. HEUMANN, Aachen : « Zum Schlingern von Eisenbahnfahrzeugen », *Org. f. d. Fortschr. d. Eisenbahnw.*, 98 (1943), No. 15/16, p. 221-235.

(15) Jarl KUUSINEN, Åbo : « Wahrscheinlichkeitsberechnungen in der Kraft- und Wärmetechnik », *Åbo Akademi* (1936).

(16) Prof. Karl MAYR, Wien : « Wahrscheinlichkeitsfunktionen und ihre Anwendungen », *Monatshefte für Math. und Physik*, Wien, XXX (1920), p. 17-43.

[656 .223 .2]

Determination of the number of wagons and locomotives required for the goods traffic,

by M. Dimitrije S. Živković,

Professor at the Higher School of Transport, Belgrade.

INTRODUCTION.

In railway operating, as with all other undertakings, the ratio between the different capacities (of the permanent way and fixed installations, of the wagons and locomotives) is the essential part of the productive capacity factor. A thorough knowledge of the laws regulating these ratios is the fundamental condition for the control of the organisation of railway traffic.

The productive capacity of the permanent way and fixed installations can be determined first of all for given transport facilities under given operating conditions.

After this preliminary determination of the production capacity of the fixed installations of a railway, which can be taken as the maximum effective of the active (available for service) stock of wagons, we can go on to the determination of the ratio between the active stock of wagons and that of the locomotives, i.e. their concomitant user.

The object of the present article is to explain methods of determining the importance of the active stocks of rolling stock and traction stock under given transport conditions.

First of all, we must explain very precisely the fundamental notions we shall use in our study.

The *active stock of goods wagons* (in future referred to as the active stock of wagons), which we will designate by the letter W means the number of goods wagons needed for transport within a given period (ten days, or a month) for the traffic. All the other wagons form the inactive stock. This consists in the main of wagons undergoing repairs and those in excess which are not required for the traffic during this period and consequently are garaged on the sidings kept for this purpose.

The *active stock of locomotives*, which we will designate by the letter M, like the active stock of wagons (W) means the number of locomotives needed to assure the goods traffic in the given period; therefore it does not include any locomotives undergoing repairs and spare locomotives in the sheds. In the active stock of locomotives, we also do not include those needed for shunting. The number of such locomotives must be determined separately.

The *duration of the turn round of wagons*, designed by δ, means the average time between two successive loadings of a goods wagon, in days.

The *duration of the turn round of loco-*

motives, represented by θ is the average interval of time, in hours, which elapses between two successive jobs on leaving the shed to which the locomotive is attached, in order to work a goods service (haul a train, double heading).

The *volume of work*, designated by U, is the average daily number of loaded wagons to be transported on the railway system in question. It consists on the one hand of the number of wagons which have been loaded during the course of a day on the railway in question and on the other hand, of loaded wagons which this railway accepts from neighbouring systems during the same period.

I. — Determination of the active stocks of wagons and locomotives for a given volume of work.

The general equation of the active stock of wagons needed W for the given amount of work U and a given value of the duration of turn round δ is given by the formula

$$W = \delta \cdot U \qquad \ldots \quad (1)$$

The value W designates not only the number of wagons of the active stock, but fundamentally, the number of wagon days which must be available on the railway to cope with the volume of work U with a given duration of turn round δ.

On the other hand, the duration of turn round of the wagons can be broken down as follows :

$$\delta = \frac{l}{24\,V_K} + \frac{l}{L_v} \cdot \frac{t_v}{24} + \frac{K \cdot t_m}{24} \qquad (2)$$

This is the trinome of the duration of turn round of the wagons.

In this formula :

l = average daily mileage covered by a wagon during the duration of turn round, measured in km;

V_K = average speed measured in km/h;

L_v = the average distance between the shunting stations through which a wagon must pass during the duration of turn round, measured in km;

t_v = average time spent by a wagon at these shunting stations, measured in hours;

t_m = average time the wagon is stationary whilst goods are being handled (loading, unloading, transhipment), measured in hours;

K = coefficient of work which indicates the number of times goods are handled per unit of the volume of work.

In the expression « shunting stations », we include marshalling yards properly speaking, the stations at which trains are made up, stations through which wagons pass in transit, etc.

The following equation determines the numbers required in the active stock of locomotives M for a given goods traffic U:

$$M = \frac{U \cdot l\,(1 + \beta) \cdot \theta}{2\,L \cdot n \cdot 24} \qquad (3)$$

Here, M does not merely indicate the number of locomotives needed, but also the number of locomotive days which must be available in order to cope with the given volume of work U.

On the other hand, we have :

β = coefficient of the accessory locomotive services, by which we mean double heading as well as the necessary light runs;

θ = average duration of turn round of the locomotives, measured in hours;

L = average length of the distance run in traction, measured in km;

n = average number of wagons per train.

The duration of turn round of the locomotives is given by the formula :

$$\theta = \frac{2\,L}{V_K} + T \quad . \; . \; . \; . \tag{4}$$

in which :

T = average time spent by a locomotive in the sheds during the turn round, measured in hours.

If we now represent the volume of work U, taken from the equation (3) in terms of the other parameters, replacing the amount θ by the second member of equation (4), we will get the following formula for the volume of work U :

$$U = \frac{2 \cdot 24 \cdot n \cdot L \cdot M}{l\,(1+\beta) \cdot \left(\frac{2\,L}{V_K} + T\right)} \tag{5}$$

If, in addition, we replace the amounts δ and U in equation (1) by their values obtained from the equations (2) and (5), we get the following formula for the value of the active stock of wagons :

$$W = \frac{2 \cdot 24 \cdot n \cdot L \cdot M}{l\,(1+\beta) \cdot \left(\frac{2\,L}{V_K} + T\right)} \cdot \left(\frac{l}{24\,V_K} + \frac{l \cdot t_v}{24\,L_v} + \frac{K \cdot t_m}{24}\right) \tag{6}$$

whence :

$$W = \frac{24 \cdot n \cdot M}{(1+\beta) \cdot l \cdot \left(\frac{1}{V_K} + \frac{T}{2L}\right)} \cdot \left[\frac{l}{24} \cdot \left(\frac{1}{V_K} + \frac{t_v}{L_v}\right) + \frac{K \cdot t_m}{24}\right] \tag{7}$$

If, now, we put :

$$\frac{24 \cdot n}{l \cdot (1+\beta) \cdot \left(\frac{1}{V_K} + \frac{T}{2\,L}\right)} = A \tag{8}$$

and, from equation (2) :

$$\frac{l}{24}\left(\frac{1}{V_K} + \frac{t_v}{L_v}\right) + \frac{K \cdot t_m}{24} = \delta \tag{9}$$

we get :

$$W = A \cdot \delta \cdot M \tag{10}$$

There is therefore between the value of the active stock of wagons W (number of wagon days required) and that of the active stock of locomotives M (number of locomotive days required) a mathematical relation which is expressed by equation (10) above.

This equation (10) shows that if the values W and M remain constant, the values A and δ can vary, on condition that the product remains invariable.

We can therefore also put

$$W = A' \cdot \delta' \cdot M \tag{11}$$

but in this case

$$A' \cdot \delta' = A \cdot \delta \tag{12}$$

The value δ represents the duration of the turn round of wagons, measured in days, and the value A represents the volume of work U corresponding to an available locomotive day under given working conditions (the duration of turn round of the wagons and locomotives being given).

From equation (10), it results :

If the value of a parameter upon which A and δ depend varies, W and M remaining constant, either A must remain equal to A′ and δ to δ', or if $A' \lesseqgtr A$, we must have $\delta' \gtreqless \delta$. We must therefore get the following equation :

$$W = (A \pm \Delta A) \cdot (\delta \mp \Delta\delta) \cdot M \qquad (13)$$

Obviously, the values of W and M can also vary. Several cases may then arise in which only one of these values varies, or both may vary simultaneously, either in the same direction or in contrary directions.

It may therefore happen that

$$(W \pm \Delta W) \lesseqgtr A \cdot \delta \cdot (M \pm \Delta M) \qquad (14)$$

In this case, the equality of the two members of the equation must be re-established, which can only be done by altering either A or δ or both of them simultaneously. The equality of these two members of the equation is therefore obtained by making

$$W \pm \Delta W = (A \pm \Delta A) \cdot (\delta \mp \Delta\delta) \cdot (M \pm \Delta M) \qquad (15)$$

This shows that the active stock of wagons is a function of the parameters :

$$W = f(n;\ l;\ V_K;\ T;\ L;\ t_v;\ L_v;\ K;\ t_m;\ M;\ \beta) \qquad (15a)$$

The variation of these parameters depends on the structure of the economy, on the organisation of the operating, or on the way in which it is carried out.

We will therefore divide these parameters into three groups :

a) those in which the value is essentially a function of the economic structure: these are the parameters l, L, L_v, K;

b) those in which the value is essentially a function of the organisation of the service, the variation of which, in regular working, is the result of the economic structure (n, β, V_K), and

c) those whose value only depends upon the organisation of the service (T, t_m, t_v). The maximum value of these parameters is also function of the correct ratio between the values W and M, i.e. between the available wagon and locomotive days.

Naturally, the action of clients may also exercise a certain influence on the value of the parameter t_m.

During the duration of turn round of a wagon (δ), the wagons (the active stock of wagons W) are to be found :

a) in the trains,

b) in the shunting stations, or

c) stationary whilst goods are being handled.

The number of wagon days required for each of these operations can be determined as follows :

The number of wagon days spent on trains is :

$$W_z = \frac{U \cdot l}{24\ V_K} \qquad (16)$$

that of wagon days in the shunting stations :

$$W_v = \frac{l \cdot t_v \cdot U}{24\ L_v} \tag{17}$$

and that of wagon days whilst wagons are stationary for the handling of goods, in other words for loading, unloading and transhipment :

$$W_m = \frac{K \cdot t_m \cdot U}{24} \tag{18}$$

The total number of wagon days required is therefore :

$$W = W_z + W_v + W_m = U \times \times \left(\frac{l}{24\ V_K} + \frac{l \cdot t_v}{24\ L_v} + \frac{K \cdot t_m}{24} \right) = U \cdot \delta \tag{19}$$

In a similar way, the locomotives (the active stock of motor stock M) during a locomotive turn round θ are :

a) attached to a train;

b) in the sheds to which they belong or at the end of a run, or

c) being used for double heading or relief services, or running light, or stationary in the sheds for these accessory services.

The number of locomotive days required for hauling the trains can be expressed by

$$M_z = \frac{M}{(1+\beta) \cdot \left(1 + \frac{T \cdot V_K}{2\ L}\right)} \tag{20}$$

the number of locomotive days in the sheds by :

$$M_B = \frac{M}{(1+\beta) \cdot \left(1 + \frac{2\ L}{T \cdot V_K}\right)} \tag{21}$$

and the number of locomotive days for the accessory services and running light by :

$$M_N = \frac{M \cdot \beta}{1 + \beta} \tag{22}$$

The total number of locomotive days required is therefore :

$$M = M_z + M_B + M_N = \frac{M}{1+\beta} \times \left(\frac{1}{1 + \frac{T \cdot V_K}{2\ L}} + \frac{1}{1 + \frac{2\ L}{T \cdot V_K}} + \beta \right) \tag{23}$$

By multiplying the number of locomotive days required for hauling the trains M_z by the average number of wagons in a train *n*, we get the number of wagon days spent on the train :

$$W_z = \frac{M \cdot n}{(1+\beta) \cdot \left(1 + \frac{T \cdot V_K}{2\ L}\right)} \tag{24}$$

The expression $\frac{U \cdot l}{24\ V_K}$ of formula (16) also represents the number of wagon days passed on the trains, so that these two values should be equal; consequently :

$$W_z = \frac{U \cdot l}{24\ V_K} = \frac{M \cdot n}{(1+\beta) \cdot \left(1 + \frac{T \cdot V_K}{2\ L}\right)} \tag{25}$$

Now, as we have seen, the only possible value of the volume of work U is that corresponding to the following equations :

$$U = \frac{W}{\delta} \quad \ldots\ldots \quad (26)$$

$$U = \frac{24 \cdot M \cdot n}{(1+\beta) \cdot \left(\frac{1}{V_K} + \frac{T}{2\,L}\right) \cdot l} \quad (27)$$

It follows that the volume of work U depends on the one hand on the number of locomotive days passed in hauling trains M_z and on the other on the value of the active stock of wagons W and the duration of turn round of the wagons δ.

II. — Influence of variations in the parameters.

We are now going to analyse each of these parameters. For each of them, we will determine :

a) on what the value of the parameter depends;

b) what disproportion between the active stocks of locomotives and wagons results from a variation in the value of the parameter;

c) what steps should be taken to eliminate this disproportion between W and M;

d) what happens if nothing is done to harmonise the active stocks of locomotives and wagons; and

e) the influence exerted by the variation in the parameter on the volume of work U.

It must not be forgotten in this connection that the parameters are only averages, and must only be considered as such. Exception can however be made for the parameters coefficients β and K.

In our analysis, we take it that the values W and M remain constant, that they agree and correspond to the given organisation, in other words to the following values of the parameters :

$n = 42$ wagons, $l = 340$ km,
$V_K = 15$ km/h, $L = 80$ km,
$t_m = 22$ h, $L_v = 82$ km,
$\beta = 0.2$, $T = 17$ h,
$t_v = 8.5$ h, $K = 1.9$.

The volume of work U is therefore also determined.

1) *Parameter n : number of wagons per train.*

The number *n* of wagons per train depends above all on the organisation of the working of the operating department i.e. on the class of locomotives selected, the use made of the power of the locomotive and the length of the station sidings. But the economic structure also exercices an influence on the number *n*. This value *n* may vary in the dynamics of the transport. It also depends on the locality in which the most intensive traffic occurs, according to whether the most intensive traffic takes place on services where the number of wagons per train is the highest or those where it is the smallest.

In the case we have selected, A is given in terms of *n* by the following equation :

$$A = \frac{24\,n}{(1+\beta) \cdot \left(\frac{1}{V_K} + \frac{T}{2\,L}\right) \cdot l} = 0.34\,n \quad (28)$$

This is an equation of the first degree; A is therefore a linear function of n.

With different values of n, there are corresponding given values of A. The result is given numerically in Table I and graphically in Diagram I.

TABLE 1.

n	A
0	0
10	3.4
20	6.8
30	10.2

Let us now consider what takes place when the parameter n increases, in other words in the case in which it becomes $n + \Delta n$.

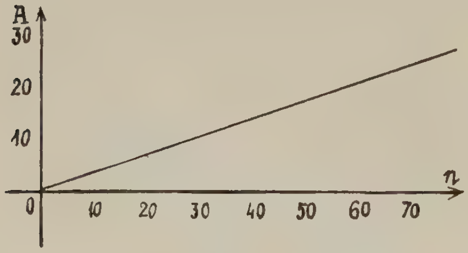


Diagram 1.

When the parameter n increases by the amount Δn to become $n + \Delta n$, the second member of equation (10)

$$W = A \cdot \delta \cdot M$$

becomes greater than the first member; we then have :

$$W < \frac{24\,(n + \Delta n)}{(1 + \beta) \cdot \left(\frac{1}{V_K} + \frac{T}{2\,L}\right) \cdot l} \cdot \delta \cdot M \qquad (29)$$

There is thus an excess of locomotive days M compared with the value of the active stock of wagons, in other words compared with the available wagon days W.

Equality can be restored by increasing the time the locomotives spend in the sheds T, in other words by lengthening the duration of turn round of the locomotives θ. We then have :

$$W = \frac{24\,(n + \Delta n)}{(1+\beta) \cdot \left(\frac{1}{V_K} + \frac{T+\Delta T}{2\,L}\right) \cdot l} \cdot \delta \cdot M \qquad (30)$$

During this time, the volume of work U has remained constant, since the values of W and δ have not undergone any change, and the number of locomotive days attached to a train, although altered, corresponds to these conditions.

If the parameter n decreases, in other words if it becomes $n - \Delta n$, the first member of equation (10) becomes greater than the second, and we get :

$$W > \frac{24\,(n - \Delta n)}{(1 + \beta) \cdot \left(\frac{1}{V_K} + \frac{T}{2\,L}\right) \cdot l} \cdot \delta \cdot M \qquad (31)$$

There is then an excess of wagon days W compared with the figure of locomotive days M.

The volume of work U_1, being limited by the number of locomotive days, the result is that :

$$U_1 = \frac{24\,(n - \Delta n) \cdot M}{(1 + \beta) \cdot \left(\frac{1}{V_K} + \frac{T}{2\,L}\right) \cdot l} \qquad (32)$$

But as in this case U_1 is smaller than U, and as the active stock of wagons W has not changed, it is necessary in consequence that :

$$U_1 = \frac{W}{\delta + \Delta\delta} \qquad (33)$$

It will be seen that in this case :

1) the volume of work U decreases ($U_1 < U$), and
2) equality can be obtained by increasing the duration of turn round of the wagons from δ to $\delta + \Delta\delta$.

To do so, the values of the parameters t_v and t_m must be altered, since the number of wagon days corresponding to the traffic on the trains W_z necessarily decreases in view of the fact that :

$$\frac{U_1 \cdot l}{24\ V_K} < \frac{U \cdot l}{24 \cdot V_K} \qquad (34)$$

and consequently, if W remains constant, the number of wagon days corresponding to time spent in the marshalling yards and while goods are being handled must of necessity increase.

Therefore

$$W = \frac{U_1 \cdot l}{24\ V_K} + \frac{U_1 \cdot l \cdot (t_v + \Delta t_v)}{24\ L_v} + \frac{U_1 \cdot K \cdot (t_m + \Delta t_m)}{24} \qquad (35)$$

the value of W remaining unaltered and the corresponding increase in the parameter δ being determined by the following formula :

$$W = U_1 \cdot (\delta + \Delta\delta) \qquad (36)$$

We will not go into the variation in the parameters l, V_K, L_v and K, since their values do not depend upon the value of W but upon other factors, as we shall see later on.

Equality must therefore be re-established in the following way :

$$W = A'(\delta + \Delta\delta) \cdot M \qquad (37)$$

2) *Parameter* L : *length of the distance of traction.*

This parameter depends principally upon the organisation of the services. It is determined as soon as the railway is built, by the construction of the locomotive sheds. This distance will remain more or less constant. But it may vary according to the action of the dynamics of the structure of transport, owing to the intensification of the traffic over shorter or longer distances of traction.

If, in the case we have selected, we express the value A in terms of L, we get

$$A = \frac{24\,n}{(1+\beta)\cdot\left(\frac{1}{V_K} + \frac{T}{2\,L}\right)\cdot l} = \frac{37}{1 + \frac{127}{L}} \qquad (38)$$

This expression gives a hyperbolic relation between A and L.

For different values of L, we get corresponding values of A which are given numerically in Table 2 and graphically in Diagram 2.

TABLE 2.

L	A
0	0
10	2.7
20	5.03
30	7.07

When the parameter L increases to the value L + ΔL, or when it decreases to L — ΔL, variations occur similar to those involved with the increase or reduction of the parameter n. Consequently all the decisions we came to in the analysis of parameter n apply equally in this case.

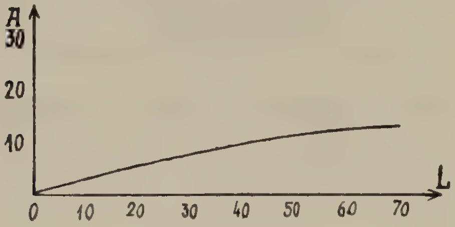


Diagram 2.

3) *Parameter β : coefficient of the accessory locomotive services.*

This parameter represents the ratio between the mileage covered by the accessory services (double heading, running light) and the mileage covered in traction. This parameter depends on the organisation of the services, especially on the profile of the lines and the power of the locomotives. But in its turn, the structure of the traffic also exercises an influence on this parameter, by increasing or reducing the transport on certain sections of line when double heading is necessary or on which there is not the same amount of traffic in each direction.

In our example, the value of A is given as a function of β by the following relation :

$$A = \frac{24\,n}{(1+\beta)\cdot\left(\frac{1}{V_K}+\frac{T}{2\,L}\right)\cdot l} = \frac{17.2}{1+\beta} \qquad (39)$$

There is a hyperbolic relation between the values of A and β.

Table 3 and Graph 3 give the values of A corresponding to different values of the parameter β.

TABLE 3.

β	A
0	17.2
0.1	15.6
0.2	14.3
0.3	13.2

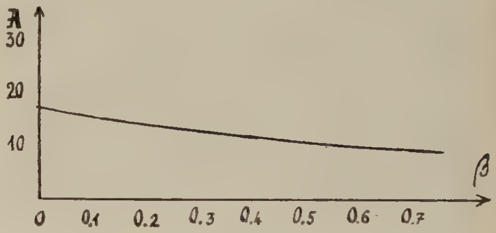


Diagram 3.

When β increases up to the value β + Δβ, the second member of the equation W = A · δ · M falls in value because

$$W > \frac{24\,n}{(1+\beta+\Delta\beta)\cdot\left(\frac{1}{V_K}+\frac{T}{2\,L}\right)\cdot l}\cdot\delta\cdot M \qquad (40)$$

But in this case the volume of work U also varies, because

$$U_3 = \frac{24\,n\cdot M}{(1+\beta+\Delta\beta)\cdot\left(\frac{1}{V_K}+\frac{T}{2\,L}\right)\cdot l} \qquad (41)$$

We therefore get $U_3 < U$. As according to the hypothesis W remains constant,

$$U_3 = \frac{W}{\delta + \Delta\delta} \qquad (42)$$

As will be seen, in this case we get variations similar to those produced by a variation in the parameter n up to $n - \Delta n$.

When the parameter β has the smaller value $\beta - \Delta\beta$, the second member of the equation (10) becomes greater than the first. We get :

$$W < \frac{24\,n}{(1+\beta-\Delta\beta)\cdot\left(\frac{1}{V_K}+\frac{T}{2\,L}\right)\cdot l}\cdot\delta\cdot M \qquad (43)$$

To restore equality between the two members, the parameter T is usually varied, by increasing it to $T + \Delta T$. The values W and δ do not vary, so that the volume of work U remains constant.

4) *Parameter* V_K *:*
average speed of the train in km/h.

This parameter is a function of the expression A and of the value δ. We will therefore take them both together. The parameter V_K represents the average speed of the train in km/h, which is quite correct for the expression A. But the expression δ corresponds not to the average speed of the train, but to the speed of the wagons in km/h, which, in view of the varying number of wagons on fast and slow goods trains, is not at all the same thing.

The difference between these speeds being very little, it is quite legitimate to take the average speed of the train instead of the average speed of the wagons in practice. It should be noted that we do not know the speed of the wagons.

The parameter V_K depends above all on the organisation of the service, as well as the timetable. But the structure of the transport also exercices an influence upon the value of this parameter, the average speed differing according to districts and the amount of traffic varying from one place to another.

In our example the values A and δ are given in terms of V_K by the following equations :

$$A = \frac{24\,n}{(1+\beta)\cdot\left(\frac{1}{V_K}+\frac{T}{2\,L}\right)\cdot l} = \frac{23.2}{1+\frac{9.4}{V_K}} \qquad (44)$$

$$\delta = \frac{l}{24}\cdot\left(\frac{1}{V_K}+\frac{t_v}{L_v}\right) + \frac{K\cdot t_m}{24} = 3.17 + 14.15\cdot\frac{1}{V_K} \qquad (45)$$

There is therefore a hyperbolical relation between the values A and V_K as also between δ and V_K.

For different values of V_K, the corresponding values of A and δ are obtained as shown in Table 4 and in graph 4.

TABLE 4.

V_K	A	δ
0	0	
5	8.05	6.00
10	11.95	4.58
15	14.3	4.15
20	15.8	3.88

As the table and graph show, an increase in the parameter V_K increases the values of A and decreases those of δ. The question is to know what the final result may be and if the product of A by δ increases or decreases when V_K increases. In the practical example given, we immediately see that :

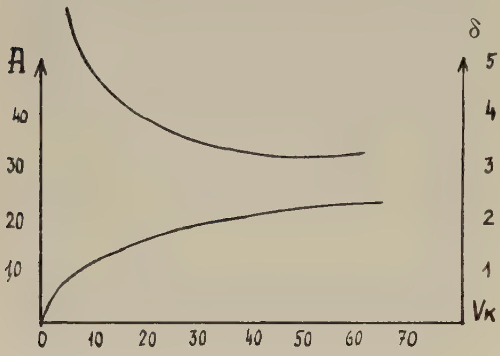


Diagram 4.

for $V_K = 5$ km/h,

$$A \cdot \delta = 8.05 \times 6 = 48.3,$$

for $V_K = 10$ km/h,

$$A \cdot \delta = 11.95 \times 4.58 = 54.8,$$

for $V_K = \infty$,

$$A \cdot \delta = 23.2 \times 3.17 = 73.5.$$

When the parameter V_K increases, the second member of the equation (10) $W = A \cdot \delta \cdot M$ also becomes greater than the first, seeing that :

$$W < \frac{24 \cdot n \cdot M}{(1+\beta) \cdot \left(\frac{1}{V_K + \Delta V_K} + \frac{T}{2\,L}\right) \cdot l} \times \cdot \left. \frac{l}{24} \cdot \left(\frac{1}{V_K + \Delta V_K} + \frac{t_v}{L_v}\right) + \frac{K \cdot t_m}{24}\right] \quad (46)$$

It can be seen that there is then a lack of agreement between the number of locomotive days available M and the number of wagon days available W.

To restore equality between the two members of the equation, use is made of the excess number of locomotive days to increase the time spent in the sheds; the stationary time T increases to $T + \Delta T$, and :

$$W = \frac{24 \cdot n \cdot M}{(1+\beta) \cdot \left(\frac{1}{V_K + \Delta V_K} + \frac{T + \Delta T}{2\,L}\right) \cdot l} \cdot \left[\frac{l}{24} \cdot \frac{1}{V_K + \Delta V_K} + \left.\frac{t_v}{L_v}\right) + \frac{K \cdot t_m}{24}\right] \quad (47)$$

But as :

$$\frac{l}{24} \cdot \left(\frac{1}{V_K + \Delta V_K} + \frac{t_v}{L_v}\right) + \frac{K \cdot t_m}{24} = \delta - \Delta\delta \quad (48)$$

we get :

$$\frac{W}{\delta - \Delta\delta} = U_4 > U \quad (49)$$

But if we need a volume of work U instead of U_4, we at once get an excess of both locomotive days and wagon days. Equality can be restored in the following way :

$$U = \frac{24 \cdot n \cdot M}{(1+\beta) \cdot \left(\frac{1}{V_K + \Delta V_K} + \frac{T + \Delta T}{2\,L}\right) \cdot l} \quad (50)$$

and

$$U = \frac{W}{\delta} \quad . \; . \; . \; . \; . \; (51)$$

whence

$$\delta = \frac{1}{24}\left[\frac{l}{V_K + \Delta V_K} + \frac{l\,(t_v + \Delta t_v)}{L_v} + K \cdot (t_m + \Delta t_m)\right] \qquad (52)$$

whence

$$W = A \cdot \delta \cdot M \quad . \; . \; . \; (53)$$

If the value of the parameter V_K decreases and becomes $V_K - \Delta V_K$, the first member becomes greater than the second, in other words :

$$W > \frac{24 \cdot n \cdot M}{(1+\beta) \cdot \left(\frac{1}{V_K - \Delta V_K} + \frac{T}{2\,L}\right) \cdot l} \cdot \left[\frac{l}{24} \cdot \left(\frac{1}{V_K - \Delta V_K} + \frac{t_v}{L_v}\right) + \frac{K \cdot t_m}{24}\right] \qquad (54)$$

As a result there is an excess number of wagon days. Equality can be restored by increasing the values of t_v, and t_m respectively to $t_v + \Delta t_v$ and $t_m + \Delta t_m$.

But as

$$U_5 = \frac{24 \cdot n \cdot M}{(1+\beta) \cdot \left(\frac{1}{V_K - \Delta V_K} + \frac{T}{2\,L}\right) \cdot l} \qquad (55)$$

we get

$$U_5 < \frac{W}{\delta + \Delta\delta} < U \quad . \; . \; . \; (56)$$

But as W remains constant, we get :

$$W = \frac{U_5}{24}\left[\frac{l}{V_K - \Delta V_K} + \frac{l\,(t_v + \Delta t_v)}{L_v} + K\,(t_m + \Delta t_m)\right] \qquad (57)$$

And consequently

$$W = U_5 \cdot (\delta + \Delta\delta + \Delta\delta') \qquad (58)$$

5) *Parameter l : distance covered by a wagon during the duration of turn round of a wagon in km.*

This parameter is again a function of A and δ. It depends chiefly either on the distribution of the sources of production or upon the structure of transport. This is only exact, especially as regards the journey made by the loaded wagon, when the railway has not laid down the transport route. In the contrary case, the journey made by the loaded wagon can be rather greater than that necessitated by the distribution of the sources of production. The journey made by the empty wagon, which forms part of the total journey made by a wagon during the duration of turn round, also depends either on the distribution of the sources of production or the transport structure. But it also depends on the category of wagon used as well as the skill with which the railway services have been organised as regards providing empty wagons for loading.

In our example A and δ are given in terms of parameter l by the relations :

$$A = \frac{24\,n}{(1+\beta) \cdot \left(\frac{1}{V_K} + \frac{T}{2\,L}\right) \cdot l} = \frac{4\,850}{l} \qquad (59)$$

$$\delta = \frac{l}{24} \cdot \left(\frac{1}{V_K} + \frac{t_v}{L_v}\right) + \frac{K \cdot t_m}{24} = 1.74 + 0.0071 \cdot l \qquad (60)$$

The values A and l are therefore connected together by a hyperbolical relation, whereas δ and l are connected together by a linear function.

The values of A and δ corresponding to the different values of l are given in Table 5 and Graph 5.

TABLE 5.

l	A	δ
100	48.5	2.45
200	24.2	3.16
300	16.2	3.87

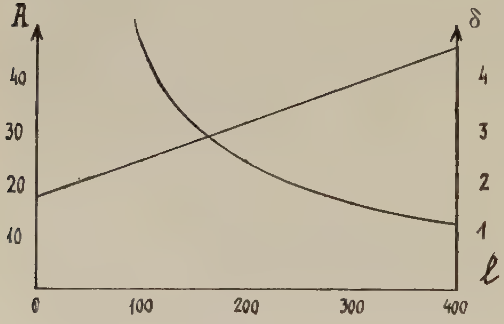


Diagram 5.

As the table and graph show A decreases and δ increases when the parameter l increases. What is the final result?

For $l = 100$ km,
$A \cdot \delta = 48.5 \cdot 2.45 = 119$

For $l = 200$ km,
$A \cdot \delta = 24.2 \cdot 3.16 = 76.5$

For $l = 400$ km,
$A \cdot \delta = 12.1 \cdot 4.58 = 55.5$

It will therefore be seen that when the parameter l increases, the product $A \cdot \delta$ decreases and the first member of the equation $W = A \cdot \delta \cdot M$ becomes greater than the second member. We therefore get

$$W > \frac{24 \cdot n \cdot M}{(1+\beta)\cdot\left(\frac{1}{V_K}+\frac{T}{2\,L}\right)\cdot(l+\Delta l)} \cdot \biggl[\frac{l+\Delta l}{24}\cdot\biggl(\frac{1}{V_K}+\frac{t_v}{L_v}+\frac{K\cdot t_m}{24}\biggr] \quad (61)$$

In this case, there is an excess of wagon days W compared with the available locomotive days M.

Here again equality can be restored by increasing the time the wagons spend in the marshalling yards and while goods are being handled, as well as by increasing the parameters t_v and t_m up to the values $t_v + \Delta t_v$ and $t_m + \Delta t_m$.

As under these conditions

$$\frac{1}{24}\left[\frac{l+\Delta l}{V_K}+\frac{(l+\Delta l)\cdot t_v}{L_v}+K\cdot t_m\right] = \delta + \Delta\delta \quad (62)$$

we get :

$$\frac{W}{\delta+\Delta\delta} = U_6 \; . \; . \; . \; . \; . \; (63)$$

U_6 being smaller than U ($U_6 < U$).

But as

$$U_7 = \frac{24 \cdot n \cdot M}{(1+\beta)\cdot\left(\frac{1}{V_K}+\frac{T}{2\,L}\right)\cdot(l+\Delta l)} \quad (64)$$

whence

$$U_7 < U_6 < U \; . \; . \; . \; . \; (65)$$

we get :

$$U_7 = \frac{W}{\delta + \Delta\delta + \Delta\delta'} \qquad (66)$$

If the value of the parameter l falls to $l - \Delta l$, the second member of the formula becomes greater than the first, because

$$W < \frac{24 \cdot n \cdot M}{(1 + \beta) \cdot \left(\frac{1}{V_K} + \frac{T}{2\,L}\right) \cdot (l - \Delta l)}$$

$$\cdot \left[\frac{l - \Delta l}{24} \cdot \left(\frac{1}{V_K} + \frac{t_v}{L_v}\right) + \frac{K \cdot t_m}{24}\right] \qquad (67)$$

This means that there is an excess of locomotive days M compared with the wagon days available W.

Equality can be obtained by varying the parameter T which is increased to $T + \Delta T$.

The result is that :

$$\frac{1}{24} \cdot \left(\frac{l - \Delta l}{V_K} + \frac{l - \Delta l}{L_v} \cdot t_v + K \cdot t_m\right) = \delta - \Delta\delta \qquad (68)$$

$$\frac{W}{\delta - \Delta\delta} = U_8 \quad . \; . \; . \; . \; . \; (69)$$

$$U_9 = \frac{24 \cdot n \cdot M}{(1 + \beta) \cdot \left(\frac{1}{V_K} + \frac{T}{2\,L}\right) \cdot (l - \Delta l)} \qquad (70)$$

$$U_9 > U_8 > U \quad . \; . \; . \; . \; (71)$$

because :

$$U_8 = \frac{24 \cdot n \cdot M}{(1 + \beta) \cdot \left(\frac{1}{V_K} + \frac{T + \Delta T}{2\,L}\right) \cdot (l - \Delta l)} \qquad (72)$$

If here again, as above, we only need a volume of work U, but not U_8, we get : $W = A \cdot \delta \cdot M$, A and δ being determined by the following equations :

$$A = \frac{24\,n}{(1 + \beta) \cdot \left(\frac{1}{V_K} + \frac{T + \Delta T}{2\,L}\right) \cdot (l - \Delta l)} \qquad (73)$$

$$\delta = \frac{1}{24}\left[\frac{l - \Delta l}{V_K} + \frac{(l - \Delta l) \cdot (t_v + \Delta t_v)}{L_v} + K \cdot (t_m + \Delta t_m)\right] \qquad (74)$$

consequently :

$$W = U \cdot \delta$$

6) *Parameter* L_v *: the average distance between shunting stations in km.*

The value of this parameter is already determined to a certain extent by the layout of the railway system, since the distance between the marshalling yards was decided when the lines were built. But here again, the average distance between shunting stations depends to a much greater degree on the structure of the traffic than on the distance between marshalling yards. If goods are loaded and unloaded at the intermediate stations, the value of the parameter L_v decreases.

The ratio l/L_v represents the number of marshalling yards which a wagon passes through during the duration of turn round.

The value of δ is given, in terms of the parameter L_v by the following equation :

$$\delta = \frac{l}{24}\left(\frac{1}{V_K} + \frac{t_v}{L_v}\right) + \frac{K \cdot t_m}{24} = 2.68 + \frac{120}{L_v} \qquad (75)$$

The relation between δ and L_v is therefore hyperbolical.

For the different values of L_v, we get corresponding values of δ which are given numerically in Table 6 and graphically in Diagram 6.

TABLE 6.

L_v	δ
0	∞
40	5.68
80	4.18
100	3.88

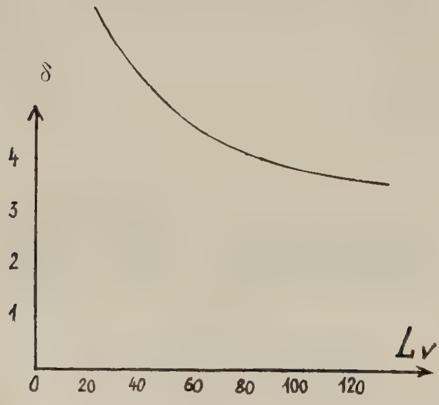


Diagram 6.

If the parameter L_v increases and takes on the value $L_v + \Delta L_v$, the first member of the formula becomes greater than the second, seeing that

$$W > A \cdot \left[\frac{l}{24}\left(\frac{1}{V_K} + \frac{t_v}{L_v + \Delta L_v}\right) + \frac{K \cdot t_m}{24}\right] \cdot M \qquad (76)$$

Equality is restored in this case by giving the parameters t_v and t_m respectively the values $t_v + \Delta t_v$ and $t_m + \Delta t_m$.

As in this case

$$\frac{1}{24} \cdot \left[\frac{l}{V_K} + \frac{l\,(t_v + \Delta t_v)}{L_v + \Delta L_v} + K \cdot (t_m + \Delta t_m)\right] = \delta \qquad (77)$$

we always get $\frac{W}{\delta} = U$. The volume of work U therefore remains constant.

When the parameter L_v decreases and becomes $L_v - \Delta L_v$, the second member of the formula becomes greater than the first, because

$$W < A \cdot \left[\frac{l}{24} \cdot \left(\frac{1}{V_K} + \frac{t_v}{L_v - \Delta L_v}\right) + \frac{K \cdot t_m}{24}\right] \cdot M \qquad (78)$$

Equality can be restored in this case again by increasing the value of the parameter T and making it $T + \Delta T$. As, in this case

$$\frac{1}{24} \cdot \left[\frac{l}{V_K} + \frac{t_v \cdot l}{L_v - \Delta L_v} + K \cdot t_m\right] = \delta + \Delta\delta \; . \; . \; . \; . \; . \; (79)$$

we get

$$\frac{W}{\delta + \Delta\delta} = U_{10} < U$$

and

$$U_{10} = \frac{24 \cdot n \cdot M}{(1+\beta) \cdot \left(\frac{1}{V_K} + \frac{T + \Delta T}{2\,L}\right) \cdot l} \qquad (80)$$

7) *Parameter* K *: coefficient of handling the goods.*

This parameter gives the number of handling operations per unit of volume of work. K is therefore equal to $\frac{U_b + U_e}{U}$, U_b being the number of loading operations and U_e the number of unloading operations. These figures naturally include the number of transhipments and additional loading operations. This parameter has well defined limiting values. It can vary between 0 and 2, according to the method of work used on the railway. It depends on the work, the railway system in question, the imports and exports, as well as traffic in transit. The value of this parameter depends entirely upon the economic structure of the country.

The value of δ is given as a function of K by

$$\delta = \frac{l}{24}\left(\frac{1}{V_K} + \frac{t_v}{L_v}\right) + \frac{K \cdot t_m}{24}$$
$$= 2.41 + 0.92\,K \quad . \; . \; . \; (81)$$

The relation between the values of δ and K is therefore linear.

For different values of the parameter K lying between 0 and 2, corresponding values of δ are obtained as shown in Table 7, as well as in Diagram 7.

If the parameter K becomes K + ΔK, the second member of the formula $W = A \cdot \delta \cdot M$ becomes greater than the first, seeing that

$$W < A \cdot \left[\frac{l}{24}\left(\frac{1}{V_K} + \frac{t_v}{L_v}\right) + \frac{K + \Delta K}{24} \cdot t_m\right] \cdot M \quad (82)$$

TABLE 7.

K	δ
0	2.41
1	3.33
2	4.25

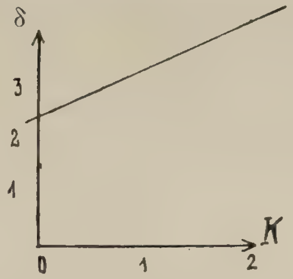


Diagram 7.

To restore equality, the parameter T must be increased to T + ΔT, because the volume of work U is the factor which determines the value of A.

As

$$\frac{1}{24}\left[\frac{l}{V_K} + \frac{l \cdot t_v}{L_v} + (K + \Delta K) \cdot t_m\right] = \delta + \Delta\delta \quad (83)$$

we also get :

$$\frac{W}{\delta + \Delta\delta} = U_{11} < U \qquad (84)$$

and

$$U_{11} = \frac{24 \cdot n \cdot M}{(1+\beta)\cdot\left(\frac{1}{V_K} + \frac{T+\Delta T}{2L}\right)\cdot l} \qquad (85)$$

If the parameter K becomes $K - \Delta K$, the contrary occurs, i.e. the first member of the formula becomes greater than the second, because

$$W > A \cdot \left[\frac{l}{24}\left(\frac{1}{V_K} + \frac{t_v}{L_v}\right) + (K - \Delta K)\cdot\frac{t_m}{24}\right]\cdot M \qquad (86)$$

To restore equality, it is necessary to increase t_v to $t_v + \Delta t_v$ and t_m to $t_m + \Delta t_m$. As, in this case,

$$\frac{1}{24}\cdot\left[\frac{l}{V_K} + \frac{l\,(t_v + \Delta t_v)}{L_v} + (K - \Delta K)\cdot(t_m + \Delta t_m)\right] = \delta \qquad (87)$$

we still get $\frac{W}{\delta} = U$; the volume of work therefore remains constant.

8) *Parameters* T, t_v *and* t_m.

So far, we have only considered variations in these parameters as consequences of a disproportion between the active stock of wagons and of locomotives, caused by variations in the other parameters.

These three parameters are above all a function of the organisation of the service and only partially of the structure of the traffic. For each given timetable and structure of traffic there are minima times T_{min}, $t_{v\ min}$ and $t_{m\ min}$ resulting from the organisation of the service in the stations and sheds. When the services are working normally in the stations and sheds, an increase in these parameters can only be the result of disproportion in the active stocks of wagons and of locomotives.

But in practice it may also happen that these parameters increase independently of any variation in the others. In this case, their increase is due to an upset in carrying out the services in the stations and sheds, but not to any disproportion of the active stocks of wagons and of locomotives.

The two cases are therefore completely different. If the increase in these parameters is the result of a poor execution of the work, it can be remedied by improving this and by the methodical execution of the work. But if the increase in these parameters is due to disproportion between the active stocks of wagons and of locomotives, it is not possible to improve the organisation of the service; on the contrary, bad operating conditions appear to be inevitable in this case. To restore these parameters in such a case to their normal values, it is necessary to re-establish concordance between the active stocks of wagons and of locomotives.

9) *Parameter* T : *average time a locomotive spends in the sheds.*

This parameter depends in the first place on the way the service in the sheds is organised, the adaptation of the timetables and the way the locomotives are manned (by one, two or three crews). The minimum time resulting from the structure of the transport and the given timetable is designated by T_{min}.

This parameter represents at the same time the maximum reserve of the active stock of locomotives. In fact, by improving the organisation of the work, by reducing T_{min}, it is possible to increase the ratio of the length of service compared with the time the locomotives are standing idle. If T is greater than T_{min}, this means that there is a reserve in the duration of turn round of the locomotives which can be put to profit by improving the organisation of the working.

10) *Parameters t_v and t_m : time the wagons spend in the shunting stations and whilst goods are being handled.*

The value of the parameter t_v only depends on the organisation of the working; that of t_m, on the other hand, depends partly on the action of clients as well : it is the time the latter need to handle their goods (load, unload, and if necessary tranship).

The parameter t_v is a function of the time needed to make up a train in the marshalling yard, the amount of the goods traffic, the average number of wagons per train, and the reciprocal adaptation of the timetables for the different sections of line.

As we have already said, the parameter t_m is a function of the time needed for loading and unloading, the time required to supply and collect wagons from the loading sidings, as well as the adaptation of the timetables of the trains clearing them to the time needed for carrying out the above mentioned work.

For each given timetable and for every structure of transport there is therefore a minimum time $t_{v\ min}$ and $t_{m\ min}$ below which it is impossible to go. All other times t_v and t_m, which will be above $t_{v\ min}$ or $t_{m\ min}$ mean that there is a reserve of wagon days contained in these parameters.

To end, we must point out that about 80 % of the duration of rotation of the wagons is accounted for by the time spent in the marshalling or shunting stations and for handling goods, and that transport only represents about 20 %. In the present organisation of the working, these parameters therefore contain very large reserves of wagon days.

The following table gives a very complete picture of the consequences of disproportion between the active stocks of wagons and of locomotives and the measures required to remedy it.

The consequences only appear in this form when the values W and M remain constant.

Out of 14 cases, the volume of work U only remains unaltered in five cases ($U' = U$); in two cases, the volume of work can increase ($U' > U$) and in seven cases, it decreases ($U' < U$).

III. — Practical harmonization of the active stocks of wagons and of locomotives in given operating conditions.

In the fifth column of the following table, we have shown the steps that have

The variation of the parameter	Involves the variation of the parameters in the expression :		Volume of possible work	Steps to be taken to regulate the volume of work		
1	2	3	4	5		
$n + \Delta n$	$T + \Delta T$	—	$U' = U$	$M - \Delta M$		
$n - \Delta n$	—	$\frac{t_v + \Delta t_v}{t_m + \Delta t_m}$	$U_1 < U$	$M + \Delta M$		$U_1 = U$
$L + \Delta L$	$T + \Delta T$	—	$U'' = U$	$M - \Delta M$		
$L - \Delta L$	—	$\frac{t_v + \Delta t_v}{t_m + \Delta t_m}$	$U_2 < U$	$M + \Delta M$		$U_2 = U$
$\beta + \Delta\beta$	—	$\frac{t_v + \Delta t_v}{t_m + \Delta t_m}$	$U_3 < U$	$M + \Delta M$		$U_3 = U$
$\beta - \Delta\beta$	$T + \Delta T$	—	$U''' = U$	$M - \Delta M$		
$V_K + \Delta V_K$	$T + \Delta T$	—	$U_4 > U$	$M - \Delta M$	$W - \Delta W$	$U_4 = U$
$V_K - \Delta V_K$	—	$\frac{t_v + \Delta t_v}{t_m + \Delta t_m}$	$U_5 < U$	$M + \Delta M$	$W + \Delta W$	$U_5 = U$
$l + \Delta l$	—	$\frac{t_v + \Delta t_v}{t_m + \Delta t_m}$	$U_7 < U$	$M + \Delta M$	$W + \Delta W$	$U_7 = U$
$l - \Delta l$	$T + \Delta T$	—	$U_8 > U$	$M - \Delta M$	$W - \Delta W$	$U_8 = U$
$L_v + \Delta L_v$	—	$\frac{t_v + \Delta t_v}{t_m + \Delta t_m}$	$U'''' = U$		$W - \Delta W$	
$L_v - \Delta L_v$	$T + \Delta T$	—	$U_{10} < U$		$W + \Delta W$	$U_{10} = U$
$K + \Delta K$	$T + \Delta T$	—	$U_{11} < U$		$W + \Delta W$	$U_{11} = U$
$K - \Delta K$	—	$\frac{t_v + \Delta t_v}{t_m + \Delta t_m}$	$U''''' = U$		$W - \Delta W$	

to be taken and the way in which to vary the active stock of wagons W and the active stock of locomotives M in order to retain the same volume of work U.

This table shows that the following cases may occur :

a) only the active stock of locomotives M need be regulated;

b) only the active stock of wagons W need be regulated;

c) both the active stock of locomotives M and the active stock of wagons W need regulating.

By varying the active stock of locomotives from M to $M \pm \Delta M$, the carrying out of the operating services in the sheds can be organised in such a way that T becomes equal to $T \mp \Delta T$.

The value which $\mp \Delta T$ must have can be calculated as follows :

$$\frac{24\,n}{(1+\beta)\cdot\left(\frac{1}{V_K}+\frac{T}{2\,L}\right)\cdot l} = \frac{24\,(n \mp \Delta n)}{(1+\beta \pm \Delta\beta)\cdot\left[\frac{1}{V_K \mp \Delta V_K}+\frac{T \mp \Delta T}{2\,(L \mp \Delta L)}\right]\cdot(l \pm \Delta l)} \quad (88)$$

from which we get.

$$\mp \Delta T = \left\{\left[\frac{(n \mp \Delta n)\cdot(1+\beta)\cdot\left(\frac{1}{V_K}+\frac{T}{2\,L}\right)\cdot l}{(1+\beta \pm \Delta\beta)\cdot(l \pm \Delta l)\cdot n} - \frac{1}{V_K \mp \Delta V_K}\right]\cdot 2\,(L \mp \Delta L)\right\} - T \quad (89)$$

In the same way :

$$\frac{24\,n\cdot M}{(1+\beta)\cdot\left(\frac{1}{V_K}+\frac{T}{2\,L}\right)\cdot l} = \frac{24\,(n \mp \Delta n)\cdot(M \pm \Delta M)}{(1+\beta \pm \Delta\beta)\cdot\left[\frac{1}{V_K \mp \Delta V_K}+\frac{T \mp \Delta T}{2\,(L \mp \Delta L)}\right]\cdot(l \pm \Delta l)} \quad (90)$$

whence :

$$\pm \Delta M = M\cdot\left\{\frac{n\,(1+\beta \pm \Delta\beta)\cdot\left[\frac{1}{V_K \mp \Delta V_K}+\frac{T \mp \Delta T}{2(L \mp \Delta L)}\right]\cdot(l \pm \Delta l)}{(1+\beta)\cdot\left(\frac{1}{V_K}+\frac{T}{2\,L}\right)\cdot l\cdot(n \mp \Delta n)} - 1\right\} \quad (91)$$

By increasing or decreasing the active stock of wagons W to bring it to the value $W \pm \Delta W$, we can organise the carrying out of the services in the stations in such a way that the parameters t_v and t_m take on the respective values $t_v \mp \Delta\ t_v$ and $t_m \mp \Delta t_m$.

As $W \pm \Delta W = A\cdot(\delta \pm \Delta\delta)\cdot M$ and $W = A\cdot\delta\cdot M$, by dividing the first relation by the second we get :

$$\frac{W \pm \Delta W}{W} = \frac{\delta \pm \Delta\delta}{\delta} \quad (92)$$

As $$\frac{W}{\delta} = U' \quad (93)$$

and $$\pm \Delta\delta = \delta' - \delta \quad (94)$$

δ' being the duration of turn round of the wagons with the modified parameters and U' the required volume of work, so that :

$$\pm \Delta W = U'\,(\delta' - \delta) \quad . \ . \ (95)$$

or

$$\pm \Delta W = U'\left[\frac{l \pm \Delta l}{V_K \mp \Delta V_K} + \frac{(l \pm \Delta l)\cdot(t_v \mp \Delta t_v)}{L_v \mp \Delta L_v} + (K \pm \Delta K)\cdot(t_m \mp \Delta t_m) - \left(\frac{l}{V_K} + \frac{l\cdot t_v}{L_v} + K\cdot t_m\right)\right]\cdot\frac{1}{24} \quad (96)$$

U' is the volume of work which we want to have, in other words that resulting from the value M and working conditions of the locomotives. We therefore get :

$$U' \lesseqgtr U.$$

If we do not take the necessary steps due to the variation in the parameters, in other words if W remains constant, and consequently $\pm\ \Delta W = 0$, δ will also remain constant and consequently $\delta' - \delta = 0$.

It frequently happens in practice that the value of the active stocks of wagons and locomotives are not harmonized with the transport and operating conditions. The inevitable result is an unfavourable effect upon the volume of work U. We will now say something about these consequences.

IV. — The inevitable consequences of a failure to adapt the active stocks of wagons and locomotives to the given traffic conditions.

It often happens, particularly in the autumn, when traffic is at its peak, that n falls to $n - \Delta n$ and l increases and becomes $l + \Delta l$. Under these new conditions, the realisable volume of work U no longer meets the economic conditions.

To be able to meet the economic needs as regards the volume of work U, even with altered operating conditions, the following steps have to be taken :

a) owing to the variation in the parameters n and l, the active stock of locomotives must be increased from M to M + ΔM, or the time T reduced to T — ΔT, and

b) owing to the variation in the parameter l, increased to $l + \Delta l$, the active stock of wagons must be increased up to W + ΔM.

The operating conditions are not analysed and the fall in the volume of work U is attributed to a poor execution of the work in the stations.

The same conclusion leads to an increase in the parameters t_v and t_m up to $t_v + \Delta t_v$ and $t_m + \Delta t_m$. Whereas in reality, this may be the cause of the insufficiency of the stock of locomotives, or a consequence of the fact that the necessary reduction of T to T — ΔT has not been made.

In cases of this kind, attempts are often made to obtain an increase in the volume of work by increasing the active stock of wagons. But this leads to an exactly contrary result, i.e. the volume of work U falls still more and

$$U'' < U' < U \quad . \quad . \quad . \quad . \quad (97)$$

It follows from what we have said that on the contrary it is necessary to :

1) reduce the time T to T — ΔT, or increase the active stock of locomotives from M to M + ΔM, and
2) increase the active stock of wagons from W to W + ΔW.

If the necessary improvement cannot be made in the active stock of locomotives from M to M + ΔM, or if those available are not quite sufficient, the value of the active stock of wagons should not be increased either, even if the stock is available; on the contrary it should be reduced in such a way that the volume of work U can be maintained under the new conditions.

The fact that when a reduction in the volume of work U occurs, it is necessary further to reduce the active stock of wagons W may seem paradoxical, but it is nonetheless true. Whether we increase the active stock of wagons or not, under the given operating conditions, we cannot obtain any other volume of work than U″, in view of the fact that

$$U'' < U' < U \quad . \quad . \quad . \quad . \quad (98)$$

If we take it that the active stock of wagons W and the active stock of locomotives M correspond to the given volume of work U and to the parameters, and that in consequence $W = A \cdot \delta \cdot M$, by varying the parameters n and l, as we supposed above, we get :

$$A' = \frac{24\,(n - \Delta n)}{(1+\beta)\cdot\left(\frac{1}{V_K} + \frac{T}{2\,L}\right)\cdot(l+\Delta l)} < A \quad (99)$$

$$\delta' = \frac{1}{24}\left[\frac{l+\Delta l}{V_K} + \frac{(l+\Delta l)\cdot t_v}{L_v} + K\cdot t_m\right] > \delta \quad (100)$$

But in this case

$$A'\cdot\delta' < A\cdot\delta \quad (101)$$

so that

$$W > A'\cdot\delta'\cdot M \quad (102)$$

Equality must be restored; this is done by varying δ':

$$\delta'' > \delta' > \delta \quad (103)$$

so that

$$W = A'\cdot\delta''\cdot M \quad (104)$$

equality in which:

$$\delta'' = \frac{1}{24}\left[\frac{l+\Delta l}{V_K} + \frac{(l+\Delta l)\cdot(t_v+\Delta t_v)}{L_v} + K\cdot(t_m+\Delta t_m)\right] \quad (105)$$

The values of Δt_v and Δt_m are determined by starting with the equality $A\cdot\delta = A'\cdot\delta''$. We then get:

$$\Delta t_v = \frac{n\cdot K\cdot t_m\cdot\Delta l}{(n-\Delta n)\cdot l\cdot(l+\Delta l)} + \frac{\Delta n\cdot L_v}{n-\Delta n}\cdot\left(\frac{1}{V_K}+\frac{t_v}{L_v}+\frac{K\cdot t_m}{l+\Delta l}\right) - \frac{\Delta t_m\,(l+\Delta l)}{l+\Delta l} \quad (106)$$

$$\Delta t_m = \frac{n\cdot t_m\cdot\Delta l}{(n-\Delta n)\cdot l} + \frac{\Delta n\,(l+\Delta l)}{K\cdot(n-\Delta n)}\cdot\left(\frac{1}{V_K}+\frac{t_v}{L_v}+\frac{K\cdot t_m}{l+\Delta l}\right) - \frac{\Delta t_v\,(l+\Delta l)}{K\cdot L_v} \quad (107)$$

It is not possible to determine directly what the value of Δt_v and Δt_m should be, because these latter vary according as to the way the value of n begins to decrease and that of l to increase, in the case of stopping trains or through trains. In the first case, the increase in the value of t_m would be the greater, in the second case, that of t_v.

However, we can determine their maximum limits starting with the hypothesis that one of them equals zero. Let us take it therefore in our practical example that $\Delta n = -2$ and $\Delta l = +60$ km. We will thus get $\Delta t_{v\,max} = 2.72$ h and $\Delta t_{m\,max} = 6.98$ h (see diagram 8).

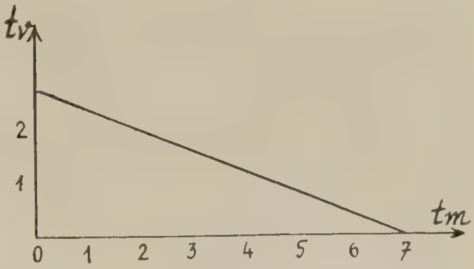


Diagram 8.

The effects of an increase in the parameters on the quantity and quality of the Operating Department service can be negative. In fact, the capacity of production of the loading sidings or marshalling yards depends upon the value of these parameters.

This capacity depends on the one hand on the length of the sidings, and on the other on the number of wagons, their length and the time they spend on the sidings. This can be calculated in the following way:

$$Z = \frac{T\rho\cdot l_g\cdot\gamma}{a\cdot t} \quad (108)$$

In this relation,

$T\rho$ = period for which the output capacity is being determined (hour, day, month or year);
l_g = length of sidings in m;
Z = number of wagons which it is possible to deal with;
a = length of the wagons in m;
t = average time the wagons spend on these sidings in hours;
γ = coefficient of user of the sidings, taking into account the necessary working space.

It follows that any variation in the value of t_v and t_m changing respectively to $t_v + \Delta t_v$ and $t_m + \Delta t_m$, and for a given value of the number of wagons days W as well as the length l_g, the capacity may prove insufficient.

It is possible to get the following mathematical relation for the maximum value of W, taking into account the fact that :

1) the length of the sidings of the marshalling yards in which the trains are reformed must, for a given organisation of the working or for $t_{v\ min}$, correspond to the following equation:

$$W \leq \frac{24 \cdot \delta \cdot l_g \cdot \gamma \cdot L_v}{a \cdot t_{v\ min} \cdot l} \qquad (109)$$

2) the length of the sidings used for loading, unloading and the transhipment of wagons under the given operating conditions must correspond to the following equation :

$$W' \leq \frac{24 \cdot \delta \cdot l_g' \cdot \gamma'}{a \cdot t_{m\ min}} \qquad (110)$$

Since

$$W = \frac{24 \cdot \delta \cdot L_v \cdot l_g \cdot \gamma}{a \cdot t_v \cdot l} \qquad (111)$$

and

$$W = \frac{24 \cdot \delta \cdot l_g' \cdot \gamma'}{a \cdot t_m} \qquad (112)$$

it follows that any increase in the parameters t_v and t_m leads to an increase of the first member compared with the second, so that the condition of regularity of working is no longer fulfilled.

As on the other hand

$$U = \frac{W}{\delta},$$

we should get also

$$U \leq \frac{24 \cdot l_g \cdot \gamma \cdot L_v}{a \cdot t_v \cdot l} \qquad (113)$$

and

$$U \leq \frac{24 \cdot l'_g \cdot \gamma'}{a \cdot t_m} \qquad (114)$$

The result is that there is a corresponding value U_{max} for $t_{v\ min}$ and any increase of the parameter t_v up to $t_v + \Delta t_v$ entails a reduction in the volume of work U and that

$$U' < U_{max} \qquad (115)$$

Practical experience has shown that shunting stations can only give the maximum output when the coefficient of user is below a certain figure.

Whenever this figure is exceeded, in other words for $\gamma + \Delta\gamma$ the output capacity falls off.

Obviously any increase in the parameters t_v and t_m corresponds to a reduction in the volume of work U. But this reduction in the volume of work depends upon the value of the number of locomotive traction days, so that

$$U' = \frac{24\,(n - \Delta n) \cdot M}{(1+\beta) \cdot \left(\frac{1}{V_K} + \frac{T}{2\,L}\right) \cdot (l + \Delta l)} \qquad (116)$$

$$U' = \frac{24 \cdot l_g \cdot (\gamma + \Delta\gamma) \cdot L_v}{a \cdot (t_v + \Delta t_v)\,(l + \Delta l)} \qquad (117)$$

When the coefficient γ becomes $\gamma + \Delta\gamma$, the marshalling yards begin to hold up the trains, owing to the reduction in the length of the sidings. Because of this the average speed falls off, V_K falls to $V_K - \Delta V_K$ which in its turn reduces the available number of traction days and consequently also reduces the volume of work U′. This reduction in its turn increases the parameters t_v and t_m, and we get :

$$U'' = \frac{24\ (n - \Delta n) \cdot M}{(1+\beta) \cdot \left(\frac{1}{V_K - \Delta V_K} + \frac{T}{2\,L}\right) \cdot (l + \Delta l)} \qquad (118)$$

and

$$U'' = \frac{24 \cdot l_g \cdot (\gamma + \Delta\gamma) \cdot L_v}{a \cdot (t_v + \Delta t_v) \cdot (l + \Delta l)} \qquad (119)$$

the value of U″ having to correspond to the relation :

$$U'' < U' < U \qquad (120)$$

The question, which now arises, is to know what is the value of the coefficient γ. This value depends on the corresponding distribution of the shunting stations and the handling of the goods, the length of their sidings, as well as the structure of transport in the period under consideration.

In Jugoslavia, this coefficient is on the average, for the railway system as a whole, under present operating conditions, 0.45 during the autumn months. As soon as this limit is exceeded, the average speed begins to fall off on the lines.

CONCLUSIONS.

Equilibrium between the active stocks of wagons and locomotives must always be maintained in terms of the operating conditions.

According to the operating conditions (long transport distances, short trains, etc.) disproportion may occur, in such a way that the active stock of available locomotives may become insufficient and the active stock of wagons too great. This may result in upsets to the work of the marshalling yards, so that this work in its turn may have unfortunate repercussions on the traffic. The active stock of locomotives, already insufficient, becomes still more so, which leads to a further reduction in the volume of work.

In order to be able to make the fullest use of the operating conditions and retain the volume of work made possible by the stock of locomotives, in this case it becomes necessary to reduce the active stock of wagons and make it agree with the active stock of locomotives.

In any case, from the point of view of operating costs, it cannot be a matter of indifference that more or less 40 to 50 locomotives or more or less 5 000 to 6 000 wagons than are needed are in circulation.

Finally, we can say in conclusion that we can state that :

$$U = f\,(W,\ A,\ \delta,\ M,\ l_g,\ \gamma) \qquad (121)$$

This fact is an explanation of the reduction in the volume of work U coinciding with a deterioration in the quality of the work during the autumn months.

[625 .19 (43)]

The effects of soil movements due to the working of mines,

by Herbert WIENECKE,

Surveyor-geometrician. Essen.

(From « *Der Eisenbahn Ingenieur* », Heft 2, 1952.)

A. The phenomenon of displacement of the soil above a seam of coal which has been mined.

In the mining of a seam of coal, an excavation is produced, resulting in disturbance of the equilibrium of the roof layers which cover it directly. This causes bending at the bottom of the seam and breaks, followed by downwards thrust of the roof layers in the direction of the excavation. The soil situated above the layers does not commence to settle — usually by bending — until the unsupported surface reaches a certain weight.

The effects of mining on the surface of the ground are shown by vertical subsidence and horizontal displacement depending on the most varied factors and have become manifest in the course of mining records carried out during the last 50 years. At first, the facts established and the theories deduced from them were contradictory; generally speaking, they were only applicable under very restricted conditions and had no generally accepted validity. According to NIEMCZYK (1) the theory of the « trough » based on the steps taken by Professor LEHMANN and confirmed in 1919, has received important supplements during the course of the last decades but still remains undisputed.

In order to observe displacements of the formations produced at the surface of the ground by mining operations, it is common practice, before starting work, to fix an observation line above the deposit, the height of the line and position are measured accurately and the movements are checked periodically.

The working of the mine being accomplished, the observations are given up at the time when one can be sure, according to experience, the effects have ceased.

If we show the results of the measurements of observation in other words the subsidence and horizontal displacements to an enlarged scale, we obtain the diagram shown by figure 1, the seam which has been worked out is supposed to be horizontal and the geological formation of the ground as uniform and unchanged as possible. Numerous observations have confirmed the correctness of LEHMANN's theory, in virtue of which each point at the surface of the ground is displaced towards the centre of the work, which varies constantly due to the progress made in extraction. The total displacement of a point, at the time when extraction is taking place, is obtained by the resultant of the « subsidence » and of the « horizontal displacement ». In case of simultaneous extraction of several veins, the final condition of the surface of the ground is the result of several concomitant phenomena.

The diagram includes the following different curves :

Curve of subsidence. — If we set out the figures for the subsidences determined by levelling and if we join the extremities of the points thus obtained, we get the curve of subsidences which has a certain similarity with a sinusoidal curve. The maximum subsidence appears at the vertical drawn through the centres of the excavation. The origin or extreme end of the curve of subsidences will be found at the point where the oblique side of the

« limiting angle » cuts the surface of the ground. Thus the limiting angle shows the extreme edge of the effect due to mine working and can be confirmed by levelling and survey. According to observations taken, its minimum will be found in the neighbourhood of 30°, if the vein under extraction is horizontal, with a maximum of about 60°.

Curve of obliquity. — The difference between the values of the subsidences of two adjacent points unequally settled down gives us the obliquity to the horizontal or the slope of the ground. By showing in the diagram the figures for the obliquity, we get the curve of obliquity, which is a function of the curve of subsidence. The two maxima of obliquity are to be found at the vertical to the two edges of the excavation A and B.

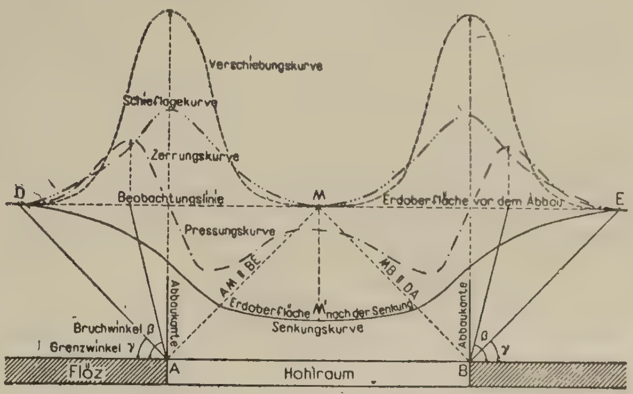


Fig. 1. — Diagram showing movements of the soil above a seam of coal which is being worked.

Flöz = layer or seam. — Hohlraum = excavation. — Verschiebungskurve = displacement curve. — Schieflagekurve = obliquity curve. — Zerrungskurve = extension curve. — Pressungskurve = compression curve. — Beobachtungslinie = observation line. — Erdoberfläche vor dem Abbau = surface of the soil before work has started. — Erdoberfläche nach der Senkung = surface of the soil after subsidence has taken place. — Senkungskurve = subsidence curve. — Abbaukante = edge of the excavation. — Bruchwinkel = angle of fracture. — Grenzwinkel = limiting angle.

Curve of displacement. — The horizontal displacement towards point M is not uniform. If we transfer on to the graph the figures of displacements with respect to point M of the different points of observation, the line joining these points is the displacement curve. The two displacement maxima are likewise to be found at the vertical to the sides of the excavation. The minimum displacement is above the centre of the excavation.

The curve of variations in length (curve of elongations and of shortenings) presents a certain relationship in its dependence on the curve of horizontal displacements. The distances between the reference marks on an observation line, which were equal before the seam was attacked, are on account of the movement of the soil either subject to a radial elongation or to a radial shortening (compression) with reference to the centre of the excavation. In the graph, the elongations are carried forward above the observation line, while the shortenings are marked below. If we compare the one with the other, we shall note that the sum of all the elongations is equal to the sum of all the shortenings, as is shown moreover by the rate of change of the displacement curve. The change over from extension to compression or vice versa takes place at the vertical of the points A and B, in the « neutral zones ». The two maxima of the extension are found at the points where the oblique side of the « angle of fracture » whose value is empirical, cuts the surface of the soil. The description « angle of fracture » was adopted because in the workings at shallow depths (50 to 100 m = 164′ 1/2″ to 328′ 1″) cracks may appear on the surface at these points. The two compression minima are found close to the edge of the interior depression. To summarise, it may be said that the horizontal displacements are a function of the vertical subsidences, since no displacements other than the depression are the result of subsidence.

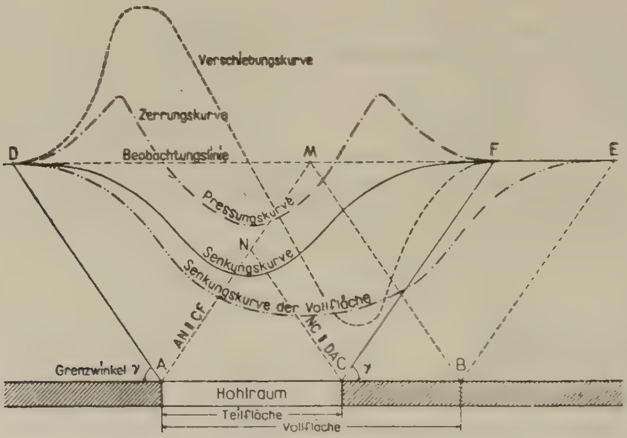


Fig. 2. — Diagrammatic representation of movements of soil above the working of a partial surface.

Senkungskurve der Vollfläche = subsidence curve of the normal surface.

The working surface shown in figure 1 constitutes, according to Professor LEHMANN's theory, a « normal surface ». By this we understand, a working surface such that the parallels at the oblique sides of the limiting angles intersect in the surface of the ground at the point M, on which the whole of the working surface operates with equal effect. In the case of a normal surface, the point M situated above the centre of the excavation, is alone subject to the maximum depression.

But in the immense majority of cases we are dealing with a « partial surface » or with a « large surface ».

By « partial surface », we understand a part of the « normal surface » in which the parallels at the oblique sides of two limiting angles intersect *below* the surface of the ground (fig. 2). In this case, the curve of subsidences is more abrupt than that of the normal surface, but they remain similar. But the similarity does not exist in the curves of horizontal displacements and of variations in length, although here again the sum of all the extensions should be equal to the sum of all the compressions. The compressions are particularly important since the partial surface has a width of half that of the normal surface. In the case of a partial surface, *only one* maximum compression surface will be produced as against two for the normal surface.

« Large surface » (Ueberfläche) is the name given to the working surface that is greater than the normal surface. The parallels at the oblique sides of the two limiting angles, here intersect *above* the surface of the ground. In this case the absence of displacement, which in figure 1 appears below point M, extends to one line; in other words, this is not only a point but an entire length, which is exposed to the maximum subsidence, without a horizontal displacement. The curve of subsidences is horizontal in that part of it which is « hollow » and has a flatter shape than in its normal surface. The objects which come to light above the depressions are subjected to a uniform subsidence and therefore hardly run any risks, but generally speaking, damage due to subterranean waters must be expected. Otherwise all the curves, at the edges of the depression, have shapes described in the case of the normal surface (fig. 1).

The aspect of the different curves described above is only realised if the seam of coal is horizontal; it changes greatly when the slope of the deposit increases (fig. 3). In the case of an inclined seam, the maximum subsidence does not come over the centre of the excavation but as much nearer to the highest edge of the seam as the slope of the same is the greater. The other maxima are likewise displaced towards the highest edge of the seam, up to the moment when no more than one single maximum of extension and compression are to be noted. Thus in this case one of the extremes of the graph will disappear. All the same, according to NIEMCZYK, the unique compression maximum is particularly dangerous on account of the phenomena of movement which are produced in the sites while the maximum extension is small and hence not dangerous.

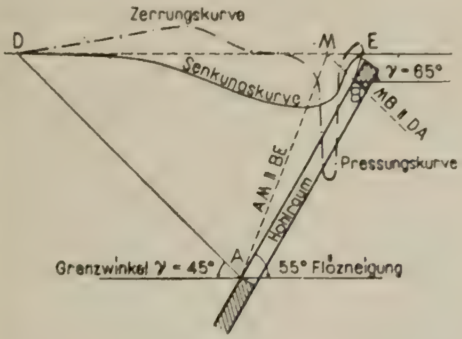


Fig. 3. — Diagrammatic representation of movements of the soil above the working of an inclined layer (normal surface).

Flozneigung = inclination of the layer.

If the slope is very marked, working of the seam from a height downwards may cause the surface of the soil to crack in the form of a funnel. The area of influence at the surface of the ground diminishes as the angularity of the slope increases, since the limiting angle at the upper edge of the seam increases considerably (up to 90°) while the limiting angle at the lower edge does not diminish in the same proportions. In the Ruhr basin, inclined seams even very steep ones, occur much oftener than in Upper Silesia.

Within the framework of the present article, we have been unable to refer to the movement phenomena in the soil caused by working a seam except to the extent necessary to make the following lines comprehensible.

B. Determination of movements of the ground arising under railway installations, and determination in advance of the movements to be allowed for.

In order to reduce and prevent the damage occasioned by mine working to valuable works situated at the surface (railways, canals, industrial plants, residential areas, etc.) the services operating mines require to have available a graphic presentation of the subsidences and horizontal displacements affecting the surface of the ground, as also of the final state of the latter when the earth movements have been completed. This determination arrived at by survey (levelling) or by calculations made in advance gives indications to the men who are working the mines on the method of working to be applied.

a) *Determination of the earth movements which have taken place.*

The vertical subsidences of the surface of the soil are in most cases imperceptible to the eye in so far as it is a question of small subsidences. On the other hand, the horizontal movements are more easily followed on account of the damage which they do to the surface installations. In order to determine exactly the movements above a zone that is being mined, we trace, for example, along the stretch of railway, a subdivided observation line, with check points set 25 m (82′ 1/4″) apart, provided the depth of mining does not exceed 1 000 m (3 280′ 10″) and 50 m (164′ 1/2″) above this depth, well provided with check points, aligned and levelled. The line must have its starting point and its remote end in an area that is not exposed to subsidences. In the Ruhr, the fixed points in ground not subject to subsidence are determined by « directive levellings » taken in conjunction with the levelling services of different Administrations, among which are included the Land Surveying Department of the Essen Management. This work takes a few days every two years. The directive levels are taken with the same degree of precision as the general topographical surveys and are linked to the altitude reference works situated outside the Ruhr coal field. The displacements of the line and of the points for observations are determined by accurate triangulation and accurate measurements; the altitude variations are likewise taken by accurate levels. In order to be able to follow the movement of each of the points on the surface, the measurements of distance and height are renewed at fixed intervals, those of distance more frequently than the height measurements. These measurements show the slow development of the depression, as against the rigidity of the subsidences. The greater the speed of subsidence, the greater inevitably the maximum tensile and compression stresses. On an average the subsidence should attain 75 % of its total value by the end of the first year, and 90 % at the expiry of the second; in this connection the method of carrying out the mining work naturally plays an important part.

b) *Advance calculation of the movements of soil that must be provided for.*

This calculation calls for knowledge of the factors which affect the movement. The importance of the movement depends primarily on the thickness, the extent and the depth of the layer of soil, and also on the method of packing the voids.

In addition, consideration must be given to the nature of the seam, and the composition of the layers of rock forming the roof, for the size of the angles of fracture and the limiting angles depend on these. The various factors to be taken into consideration are amongst others :

Thickness of the seam. — In the Rhur, the average thickness is 1.5 m (4′ 11 1/16″) and exceptionally 3 m (9′ 10 1/8″). In the northern section of the field, the thickness increases. In Upper Silesia, on the other hand, we find layers having an average thickness of 10 m (32′ 9 3/4″) and exceptionally of 20 m (65′ 7 3/8″).

Extent of the deposit. — When the extent of the seam being worked increases, the zone of subsidence increases, but the reactions at the surface diminish since the distances between the zones of extension and of compression increase.

Depth of the deposit. — The greater the depth, the smaller the maximum subsidence with the *same amount* of excavation. If the depth is great, the *zone affected by subsidence* increases, evidently, but the *volume of depression* resulting remains the same. The materials for filling up the excavation are simply borrowed from a larger area. Some decades ago, it was admitted that at great depths, the subsidences « became exhausted »; to those who know the conditions, this statement is not accurate. Whereas, with equal excavation, the maximum subsidence diminishes when the depth increases, we get in the working of a « normal surface » a maximum subsidence *equal at all depths.* When the depth increases, the volume of the depression produced increases, the area of influence at the surface increases equally and from these the interval between the maximum extension and the maximum compression. Due to this fact, the variations in length are spread over longer distances and consequently are reduced, which in turn results in giving a more shallow depression and in reducing the obliquities. As in the future, extraction will take place in the Ruhr at considerable depths, notably in the northern part of the field, there is reason to expect, according to present indications, that the damage due to extensions and to compressions will be notably reduced.

Method of working. — A distinction is made between working with and without pack walling.

The latter method of working in which after extraction the roof layers are allowed to collapse, thus filling up the excavation, causes at the surface of the ground subsidences which may in all amount to the whole thickness of the vein; this will cause damage due to horizontal displacements, as also obliquities certainly greater than when the excavation is filled up. Moreover it is with this method of working that the longest duration of the harmful effects has been recorded (up to 15 years). For maintaining railway installations in particular, extraction without filling up presents very marked disadvantages.

The other method of working is the filling up method in which a certain resistance to the collapse of the roof layers is introduced in advance. According to the density of the packing, the subsidences and displacements at the surface of the ground, as also the duration of the harmful effects are reduced, without however preventing them altogether. For example, by packing with compressed air, which is costly, the subsidences are reduced to 25 %. The process consists in using compressed air to drive stones — and the debris of extraction — into the excavations. Still better results are obtained, since the subsidences do not exceed 5 %, by the process of pumping sand and water under high pressure to fill up the excavations.

The choice of method in filling up is very much affected by the comparative cost between working the mine without filling up and the cost of so doing, account being taken of the cost of repairing damage in each case.

The value of the angle of fracture depends on the *nature and composition of the rocks.* Layers of marl like those encountered in the north of the Ruhr basin will produce angles of fracture that are less open for example than layers of sandstone. The more acute the angles of fracture, the less marked are the effects at the surface. Against this the more resistant the rock, the longer the subsidences and horizontal displacements take to show themselves and the longer they last. In addition, the value of the limiting angle is likewise a function of the nature and composition of the soil.

These are the different factors which affect the phenomenon of movement of the soil.

The advance calculation of the movement of the soil is arrived at by points, in other words, the subsidences and displacements that have to be taken into account are calculated independently for each point. While in the calculations intended for the protection of marshalling yards, industrial plants, residential areas, etc., the different points for which the calculations have been made are linked up by a network, to protect railway lines, canals, etc., points situated along the line are joined by a line. The distance between these reference points depends on the depth of the seams. Being able to determine in advance the different phases of the subsidences and horizontal displacements, the working can be directed accordingly. In addition, the damage likely to occur can be assessed and allowed for in the neighbourhood of the boundaries of concessions, when there are several mine workings, which, from the point of view of later claims for damages, presents particular interest both for the mine workers and those presenting claims. The advance calculation can be made today with an accuracy of approximately 10 % for the subsidences and 18 % for the horizontal displacements; it covers the subsidences, the obliquity, the curvature of the soil which is of great importance in the case of stresses in structures subject to bending, as also the horizontal displacement and the tensile and compression stresses resulting from them.

An explanation of the method of calculation would take us beyond the framework of this article.

With the help of the values of the vertical and horizontal displacements for each point fixed by measurement or by calculation, lines of equal subsidence can be traced, the density of which shows the importance of the obliquity (slope of the ground). The more tightly these curves approach each other, the greater the danger to the features on the surface. The extensions and compressions are shown — as in figure 1 — by overlapping sections corresponding to the observation lines, in the case when measurements are made on site, and by the measured points when the calculations are made in advance. In combining the plan (tracing) showing the subsidences, extensions, compressions and obliquities, with the plan giving by means of curves of variation of levels, the features of the surface of the ground before working has taken place, we obtain an image of the final state of the surface of the soil after its relative stabilisation. It is hardly possible to speak of an absolute stabilisation in the southern and central parts of the Ruhr coal fields for the following reasons :

At the end of the carboniferous era, the coal formations of the Ruhr basin to the east of the Rhine were subjected to orogenic action which caused horizontal pressure to operate from the South East on the coal deposits which they folded over to form anticlines and synclines lying South-West — North-West. The most important folds were produced in the South-Eastern section of the basin, and this gave rise to coal deposits of different extents. Amongst others, there are the synclines of Bochum, Essen and Lippe among which are found the anticlines of Wattenscheid, Gelsenkirchen and Vest. Basing his estimates on the results of periodic measurements made over the last 30 years, GRAHNER (2) considers that the peaks of the surface at the vertical of the sides of the anticlines constantly move towards the synclines, because the curves of the datum lines lying S. E.-N. W. show compressions in the synclines and extensions to the south and north of these points. On the other hand, the curves of the datum lines having the same orientation as the anticlines and synclines, i.e. S. W.-N. E. only show very slight variations in length. The results of surveys made at different periods would confirm the theory that the displacements, generally speaking, only take place in the direction S. E.-N. W. or inversely.

C. Effects of mine working on railway installations and ways to prevent the reactions.

The *subsidences* may change the gradients of the tracks to such an extent that paragraph 7 of the Regulations for Construction and Working could no longer be adhered to. Possible results might be : breaking of couplings, when a train stopped by a signal at the bottom of a dip in the line has to start up again, more double-heading required, disturbance of the shunting arrangements by gravity or even making this impossible if the gradients of a hump are noticeably modified, so that the wagons stop too soon on the branch lines or even run back and have to be sorted out one by one. If the speed of subsidence is considerable, the sleepers may become loosened and displaced in places and there may even be gaps in the packing of the ballast on account of the rails not dropping as quickly as the ballast. Although strictly speaking there is no fear of accidents being caused in the working due to subsidence, the most usual movement to occur, but on the other hand only developing progressively, it is absolutely indispensable to remedy this state of affairs in order to assure the complete safety of the operating. Making good such damage involves appreciable outlay, especially when it is a question of subsidences of bridge supports or of raising the levels of marshalling yards and goods yards (loading ramps, etc.).

In the extension zones, *horizontal displacements* increase the play at the joints, so that the fishplate bolts have even been sheared off. For the same reason, there is premature wear of the vehicles. On the other hand, in the compression zones, the thrust produces transverse stresses, modifications of radii of curvature and even deformation and lifting of the track. Under the influence of the transverse forces, the tracks which usually do not follow the axis of depression may find themselves out of line in respect to the centre lines of the tracks. These damages naturally arise less frequently on the main line tracks, which are subject to constant supervision, than on the tracks of secondary lines. Since it is the compressions which cause the greatest danger to the track, RELLENSMANN (3) recommended, no doubt for the benefit of the mines, the use of shorter rails (15 m [49′ 2 1/2″]) with more open joints (22 mm [7/8″] gap) in order that the compressions could be withstood at the same time as the stresses due to the temperature and to the tendency to creep.

One part of the extensions and compressions at the surface of the ground is damped by the rails themselves, as may be confirmed by comparing the play at the joints and the permanent verification of the observation line traced by the mining undertaking along the railway line. RELLENSMANN estimated that a stress on the soil (in compression or in extension) corresponding to a variation in length of 0.25 % will not be of serious effect on the track of the railway line and he proposes in order to reduce the damage done to the tracks, the deposit being assumed to be horizontal, to adopt the following method of working which he considers to be the most advantageous : starting with the axis of the track, to hew on as wide a front as possible on both sides. In this way the edges of the galleries only cut the axis of the track twice, which results in a uniform subsidence, so that should readjustment of the joints be necessary, this can be effected in a single operation. Whereas on the other hand, if the hewing is carried out at right angles to the axis of the track, it will be necessary to make an adjustment for each rail, and in this case the maximum compression on a part of the whole surface having a width equal to half that of the normal surface is particularly dangerous. Moreover, the time necessary for supervising the tracks is extended to the whole time required for working the deposit. After this, there is still a critical phase when the compression, starting from the fixed front and the mobile front meet at a point in the axis of the track at the time when the partial surface becomes the normal surface (fig. 2).

A statement of these dangers suffices to show the very great importance of the above steps for the ascertainment as accurately as possible of the changes that have taken place or of the calculation in advance of the final state of the surface of the ground when the working of the seams will be completed. A minutely detailed plan of the working of the mine makes it possible to reduce to the minimum the damage to railway installations, even if they cannot be entirely eliminated. Thus, for example, under the system of « harmonised » working of the mines, the harmful effects can be entirely suppressed by tackling two seams at the same time in such a way that the zone of extensions of the one is arranged to coincide with the compressions of the other and vice versa. Damage to a surface work that is particularly costly, for instance a building (Kreuzungsbauwerk), are minimal so long as the working of the mine only causes vertical movements, i.e. when hewing is started immediately underneath the work in question and carried out in both directions at the same time. In such a case the building actually remains permanently in the zone of maximum subsidence, at the deepest point of the depression, and if the work is carried on quickly, is not exposed to either extensions or compressions of serious importance. Opinion is divided on the question of « safety piers » arranged beneath units of great value on the surface, i.e. on the method which consists in reserving a supporting layer of the necessary dimensional extent for protecting such units. **Niemczyk** believes that at great depths a « safety pier » incorrectly calculated will bring about much greater damage to surface railway installations than mining coal followed by methodical packing, of which the after effects moreover can be calculated in advance. The safety piers at the limits of concessions always cause a break in the cross section of the lines and the irregular cutting of the piers offers special dangers for the buildings.

Beside such damage to surface railway installations, there will be other damage which is not rectricted to railways, as, for example, disturbances of water supplies and of the level of the water table which may cause at times of abundant rains flooding, the formation of swamps, and also the forcing back of the water in the case of reversal of flow in the sewers. In addition, it has often been noticed in the Ruhr basin that cracks have appeared in the masonry of buildings or of bridge abutments, even to the extent of disconnecting parts penetrating into the depression. The cracks due to expansion of the masonry have almost the same orientation as the angles of fracture (60°-70°). On the other hand, the compressions cause warping of the masonry or of the horizontal cracks. But is is not only the visible cracks which give cause for anxiety, for according to the diagram, the obliquities reach their maximum precisely at the points where there is neither extension nor compression (fig. 1). As regards especially costly industrial plants, e.g. electric power stations, obliquities of 0.5 $^0/_{00}$ are already considered as a maximum. The obliquities cannot be definitely stated except by exact measurements and accurate levelling (*).

To conclude, let us repeat that the movements of the soil, and the damage which this causes at the surface can be attributed not only to the working of the mines but also to earth movements of greater amplitude, to tectonic modifications limited by regions, to subsidences due to erosion by water or to lixiviations, to contractions of the earth's crust due to drought, etc.

D. Working of the mines and the railway.

The General Law on the Mines (*Allgemeine Berggesetz* — A. B. G.) of the 24th June 1865 applicable to the former Prussian territories, obliges the people who work the mines to indemnify all damage caused by the person working the mine not only to *landed property*, for example by the formation of swamps, or loss of land suitable for building, but also damage to personal property and property permanently associated with real estate. Under this ruling all damage to the permanent way, office buildings, railway stations, signal boxes, locomotive depots, bridges, telecommunications and signalling installations, as also gas and water mains, etc., is covered. Indemnification of indirect damage, as for example the difficulties created in the train service and running of trains, may also be followed up. According to the mining law, damage due to working of the mines constitutes a « pecu-

---

(*) It would appear desirable for a colleague, a building specialist, to state the necessary safety measures to adopt in order to avoid damage to buildings due to the working of the mines.

niary prejudice » the importance of which must be determined by the difference between the value of the property before and after the action.

It is for the injured party i.e. in general the owner of the property to prove the damage. He can always call for a plan of the mine when he wishes to make a claim to establish the justice of his claim. Title to the right to claim is limited to three years from the date the damage was confirmed — i.e. the depreciation in the value of the property for the owner of real estate — and of his principal. The Bundesbahn guarantees itself if necessary against the prescription by calling for an acknowledgement of the obligation to indemnify on account of damage.

The extent of the right of the owner who has suffered loss to claim indemnity finds its justification in the liberal spirit of the law of the XIXth Century. According to Heinemann (4) the person working the mine was considered an intruder in the unlimited depth of the property of the real estate owner, judicially entire. According to this concept, the owner of the mine has no other right than to seek and extract the minerals (coal, minerals, etc.) which are included in the concession relating to the property of a third party. By way of compensation, he accepts the obligation to make good. Nevertheless, in the laws of the last 25 years, one sees the appearance of the idea of a certain duty on the part of the owner of the landed property to adapt himself to the general interest, and hence amongst other points to the necessities of the working of minerals. Besides, laws and decrees have been increasingly passed permitting the mines to oppose the construction of undesirable installations. Regions threatened by subsidence of the earth's surface may for instance be declared as « ground for the protection of mineral exploitation ». However, the A. B. G. definitely refuses to allow the right to oppose the provision of public transport installations. They have only the right to be *considered* in connection with the method to be adopted for carrying out public transport installations which must be arranged to cause the minimum of difficulties for the owner of the mines.

It will therefore be understood that in order to avoid heavy expenditure on account of indemnities to be paid to proprietors, the persons working the mines seek to acquire ground which has been attacked or threatened, in order to enable them to intervene in the preparation of construction plans and to demand of the persons acquiring the properties later on, a renunciation in advance of any demand for indemnity on account of damage caused by working the mines.

If, on the other hand, large deposits of coal would have to remain unworked in order to protect the surface of the ground, the rent that could be demanded for the property would be seriously compromised, the more so since according to indications given by the owners of the mines, the expenses arising from indemnification of the proprietors who have suffered damage already come to from 1 to 2.5 marks per ton, without considering the cost of repacking the excavations.

In considering the legal indemnity provided for damage suffered by the railway installations, it is noted in addition that the railways, like public transport organisations in general, find themselves in a situation definitely more favourable than the private proprietors of real estate as regards mining operations.

In any case the protection only extends to land used for the operating of railways properly speaking. Whereas a private owner is bound not only to put up with any operations conforming with the regulations on mining, but must also take into account the steps he is obliged to take and that his rights to indemnification are limited, the railway may demand of the mine a method of working ensuring the safety of the railway, whether it is a question of the start of the working or during its continuance. The control of authorised exploitation by the superior authorities is administered by the Mines Service Department. In certain special cases the Railway Management is consulted before the granting of the right to work the mine. Modification or even cessation of the operating may be required if there is no other way of ensuring safety, and this may be insisted upon without the mine owners on their side having the right to claim compensation for the loss they suffer through having to provide safety piles On the other hand, when the mine owners had the concession before the plans for the construction of the railway had been decided upon, they have a right to compensation for any work they have to do to assure the safety of the railway. It is evidently exceptional for working to be stopped entirely under railway installations, but the economic situation of the Bundesbahn makes it necessary for it to obtain full value for all the rights to compensation granted it by law. The mine owner can in general evade responsibility on account of damage to new structures if he proves that the landed proprietor is guilty of neglecting to take into account the risks foreseeable in mining operations. He is warned by showing him the risks which threaten the new structure. As regards the railway, this notice is ineffective if it is a question of damage due to working a new mine, in other words on a date after the *date of approval* of the plans for the construction of the railway, for it is at the latest from this time that the mine owner must take the railway into account. The owners protest against the adoption of the date of *publication* of the plans as the start of their obligation to indemnify because modifications are often made in the tracings of the lines after this date, so that they may have to take superfluous precautionary measures. In view of the density of the Ruhr railway system, problems of a particular nature inevitably present themselves, but these are usually solved by friendly agreement between the railway management and the owners. Thus for example a working might be desirable from the railway point of view and gives rise to less damage than the maintenance of the safety piles because the adjacent concessions have already been worked. Under the canals which require long stretches of horizontal waters, such working might be more urgently needed than under the railway. The obligation to maintain the working cannot be opposed according to the law by the railway or any other organisation for public transport as regards the mine workers. These latter are in effect bound to provide indemnity for damage which they cause to any landed property but not to the ground landlord : this is the case for example when a railway crosses above land which does not belong to the railway administration, as frequently happened with lines constructed during the war. The cost of maintenance increased as a result as well as the safety measures required in connection with the buildings, such as anchorages and strengthening works were also costs to be borne by the mine owner who, in cases like this, shares in the cost involved by such measures as soon as the railway is built. In the same way, depreciation in the value of the real estate due to the risk inherent in mining is already considered as a damage occasioned by the working of the mine.

According to a judgment of the Tribunal of the Reich V 61/37, dated the 22nd December 1937, damages have already been caused by the mining operations when special expenditure on staff and materials for land survey are needed for exceptional permanent levelling work in order to avoid imminent danger. In short, the value of the use of the lands belonging to the railway is reduced by the amount required for carrying out exceptional surveys. Since the Bundesbahn is unable to collect these charges from its customers in the form of general costs of operating, it is in accord with the principle of rationalisation to make the mine owners repay the cost of carrying out the levelling operations which are only required on account of the work on the mines. For the network controlled by the management at Essen, this represents an annual sum of about 100 000 D. M., not including the cost of surveys due to special difficulties due to mine working, amongst other things more frequent markings-out, observations of bridges, difficulties in carrying out measures in the work of delimitation and listing of details, all of which represent a still larger sum.

Compensation can be given either in the form of a cash payment (i.e. a capital sum not a rent) or by restoring the original situation, which is more practical from the economic point of view. This second possibility is the most frequently adopted in the case of damage to railway installations and the line or the stations, made good by the mine owner, taking into account subsidences still to be provided for. If, however, it becomes necessary to provide in addition to the restoration, alterations of some considerable extent, the railway will itself make out a claim statement and charge up to the mine owners the costs due to the working of the mine, including administrative charges.

Lands not belonging to the railway and necessary for the reconditioning, must be acquired by the mines and handed over to the Bundesbahn. Lands belonging to the railway must be repaid to the Bundesbahn in the form of land. When a new railway line is being built, the mine owner concerned will intervene from the start in order that when acquisitions or expropriations of land occur, account will be taken of the filling in which may later be required.

The importance of the re-arranging of a railway line depends among other things on the adjacent conditions, e.g. parallel roads in use and also on probable junction lines in the future. In the case of considerable re-arrangement, it may be necessary to substitute for example a level crossing by a overhead bridge or by a subway. All claims by the railway must be established under conditions of perfect fairness, since such work will always result in a definite material advantage. The mine owner cannot be asked to restore installations which are no longer of any use. For this reason, in his judgment V 61/37 of the 22nd December 1937, the Reich Tribunal refused to reconstruct a gravity hump because the expert advised that it was not essential. For the same reason, it would not be possible to insist upon the restoration of the former profile in every case, if less favourable profiles did not make it harder to operate. The immediate reconstruction of a railway line may be refused by the mine owner if he can show from his programme of exploitation that the work to be carried out shortly will result in a natural equalization of the level. In cases of this description, the Bundesbahn may claim suitable compensation for the operating difficulties created, as also for the expenses involved; nevertheless, the partial reconstruction necessary for guarding against the dangers of immediate exploitation must be carried out at once. The depreciation of the landed property existing after the repair, e.g. the loss in the quality of the land for building, the reduction of the life of structures, as well as the pecuniary loss arising before the damage is repaired, such as the increase in operating costs or maintenance costs, etc. likewise justify a claim for compensation. There is also the rare case of the claim for damages on account of loss of area in the case of a reduction in the surface of a piece of land on account of the compression, but such a claim can only be put forward when the limit of official error in the calculation of the area has been exceeded. In such a case, the mine owner may compensate the owner by means of a rent, if he can prove from his plans for working the mine that an appropriate orientation of the work will put an end to the compression. On the other hand, in the event of absolute displacement there is as a general rule no pecuniary claim to be allowed. On the other hand, the mine owner may credit the Bundesbahn with the advantages resulting from the restoration of the former system : a new road, the suppression of a crossing keeper's post when a level crossing has been eliminated, and in certain conditions, gains in area due to extension of the land concerned, and deduct this from the Bundesbahn's claim to compensation.

E. The movements of parcels of land resulting from the working of mines.

The question of ownership concerning parcels of land affected by movements of the soil was cleared up for the first time in 1902 by SCHUHMACHER. Similar theories were elaborated later on. The following concepts are used as a starting ground: the boundaries of the parcels only hold good at the moment of the creation of an independent parcel. The judicial content of the parcel is determined « geographically or geometrically » even when it is detached from its boundaries. It follows that in case of an eventual displacement of the boundaries due to subsidence of the land, whether absolute or relative, the owner may demand a new boundary at the same place where the old boundaries were, which would restore his parcel to its original geometrical position. But the result would be that at every re-establishment of the boundaries, the enclosing walls and the corresponding areas would change their ownership or alternately the enclosing walls would have to be moved.

The hypothesis serving as a basis for paragraph 912 (projections) — in the erection of the building there must be a projection — is no longer true in the case of a structure which has moved with the displacement. There arises yet another difficulty in the event of transfer of ownership of the adjacent parcel of land in the meantime, if the buyer estimates his rights according to the local conditions. In practice, the re-establishment of the parcel of land to its initial position can only be considered after triangulation and polygonation followed by a survey at relatively short intervals. This would enable the movements due to the working of the mine, which have occurred since the parcel was formed, to be determined. The question of the actual practical realisation is sufficiently solved by the statement of the amount required to meet the charges.

However, if it is presumed that the re-establishment of the former boundaries is really possible in a particular case, we find ourselves in company with SCHUHMACHER in the presence of the most varied means for re-establishing the ownership of the parcel of land in its initial form. In addition to the volontary or enforced collaboration of all the landed proprietors interested in the displacement zone, followed by the regulation of all the conditions of boundaries and ownership in a process of repartition, SCHUHMACHER advocates the action arising from the right of ownership and especially the action by delimitation.

The *action arising from the right of ownership* cannot be recommended unless the petitioner can show the former boundaries of his parcel of land. But the petition cannot succeed unless the displacements at the site of the parcel are stopped and unless these constitute according to paragraph 946 of the German civil code an essential characteristic of the land belonging to the petitioner. As long as it can be proved that this stoppage has not been effected, the boundaries invariably continue to indicate the property. It is difficult to answer the question as to when the stoppage took place, since in the event of increasing depth the number of layers which produce reactions at the surface is always very considerable and consequently the date of the stoppage cannot be indicated with certainty.

The *action by delimitation* is considered to be a possibility offering greater prospects. However, according to SCHUHMACHER, it implies a confusion in the boundaries which moreover already exists in the case of displacement of the boundaries, the cause of the confusion being of no importance. The petitioner is advised to remember what he has lost. If he neglects this action, he must accept his reduced surface area. Other legal experts, on the other hand, deny absolutely the admissibility of such action by delimitation.

The proprietor is not interested in *absolute displacements* of all his land since, except in the case of certain valuable materials in the soil such as clay or sand, he does not suffer any pecuniary loss. But it is quite otherwise in the case of *relative displacements* of the boundaries owing to extension or compression revealed by comparing the former and present areas of the parcel of land in question. It is only to be expected that the owners will protest when the area of their parcel of land is reduced. Such action will however be limited to valuable land in urban districts if one compares the value of the land with the cost of the necessary surveying for the purpose of determining the changes that have taken place. In cases of this kind, the only possible compensation is the payment of a capital sum, for it is impossible, for the reasons given above, to demand the restoration of the original conditions. According to **GRAHNER**, who in his thesis made a detailed study of the importance of horizontal movements of the parcel of land, such compensation should refer exclusively to the difference in area exceeding the official error, since it is for this difference alone that one could guarantee the existence of damage due to the working of the mine. In view of the way the land is parcelled out in the towns of the Ruhr coal basin, in the great majority of cases, the differences of surface area will lie within the limits of official error. As regards the large areas of built up property, the mine owners hope to be able to avoid claims for compensation by demonstrating that the extensions and compressions cancel each other out. In the application of the limits of official error, the time which has expired between the comparative measurements is of capital importance.

As far back as 1911, **SARNETZKY** (5) opposed the theory defended by **SCHUHMACHER** and suggested in its place a procedure similar to that of the Prussian water board code, i.e. that the surfaces determined should be introduced into the survey every time.

GRAHNER supported a similar conception and demanded that the judicial content of the parcel should follow all the movements caused by the working of the mine. In his opinion the value of the total invariability of the location of the land in space is of secondary importance compared with the possession of a single and identical mass of earth.

These conceptions are in opposition to the legal conception according to which the land is « real estate ». This is why it is also impossible to complete the regulations on surveying, II, No. 86. For this to be possible, the law on the Mines (A. B. G.) would have to be modified in the same sense. To my knowledge no lawyer unfamiliar with the working of mines has taken up a stand in these last years on the movements of land caused by the work of mining.

F. The effect of movements of soil caused by the working of the mines on the revision of the cadastral surveys.

The variable displacements of adjacent measuring points elongate, compress and deform the bases of measurement. The lengths and the angles vary continually. Straightness of line, parallelism and perpendicularity obviously cannot be preserved under these conditions.

Before considering the influence of the movements of earth on the cadastral revisions, we shall say a word about their influence on the plotting of the polygons required in the large detailed plans. These plans are of special importance in the mining basin of the Ruhr because the last triangulation, made in 1919-1920, was not based on a choice of points which were non-susceptible to subsidence. A fresh triangulation which, like the direct levellings, should be made in the shortest possible time is obviously desirable, but cannot be undertaken at the present time in view of the expenditure it would involve. Moreover, the impossibility of taking sights at long distances due to the industrial smoke increases the value of the determination of points by the plotting of polygons. It is a fact that if the junction points are not sheltered from the effects of subsidences, the mistakes made in joining up the diagrams will always be greater than the limits of official error. But short plays of polygons can be inserted in the old drawings by proportional distribution of the variations in length (fig. form 19) and in the longer diagrams by making use of the fixed points marked on the plans and taking as a reference the notes in the levels survey notebooks. In both cases, the « principle of proximity » is respected as far as possible. The polygonation generally needed in the progressive reconstruction of the cadastral plan is preferably made immediately before the cadastral plan is revised, so that the picture of the area should be as nearly true as possible.

The determination of the legal boundaries of the landed properties, which precedes the detailed survey properly-speaking, and which in practice, contrary to SCHUHMACHER's conception, is made by starting with those boundaries modified by the working of the mines, in many cases naturally calls for a more extensive measurement than elsewhere since it is also necessary to look into possible future modifications to the boundaries. These determinations present considerable difficulties, particularly in the case of the coal fields on the left bank of the Rhine and in the north of that on the right bank (see B, last paragraph). In these mining regions, all the former surveys, including the fundamental surveys have to be used for determining the boundaries, as the movements do not always have the same signs. While in the rest of the Ruhr basin, the signs of earth movements are usually invariable, the results of the last surveys are of greater importance. Nevertheless, even in these regions, it must not be forgotten that the horizontal movements of a point on which the simultaneous working of several seams has an effect, may partly be annulled or even entirely changed with the result that the point in question may have returned to its original position. In the progressive reconstruction of the cadastral survey, it is desirable to take note of all the former measurements taken, especially the most recent ones, although in general they should be brought back to the fundamental figures, if there are no greater divergences in the limits of error. The use of the latest figures of measurement is always necessary, equally when it is a question of re-establishing an isolated measuring point among points or extant limitation. Of course it is not a question of running a straight line between the point of origin and the point of extremity, if the alignment has been curved in the space interval. In the same way measurement lines broken in course of time, cannot be re-established as a straight line on the principle of their proximity. As regards the divergences in a measure of length, it is necessary to take into account not merely the difference between extremities but also the differences between the divergences noted in the length of the alignment. In determining the limits of an average detail survey, one is restricted to measuring the relative movements of the soil, if reference is made to the nearest fixed points. Any absolute displacement which might have occurred to these fixed points will then remain unobserved.

What is the value of the divergences noted? While GRAHNER, basing his opinion on periodic measurements of length repeated over several years, estimates that 90 % of the divergences remain within the limits of error and that variations in lengths of 1 % due to extension or compression generally speaking constitute the maximum. SCHUHMACHER bases his conclusions on much greater divergences — several times greater than the divergences of error. The divergences found when the

Geometrical Department of the Essen Railways carried out measurements of length often exceeded the limit of 1 %. Here again the time between the measurements under consideration is of the first importance.

There is no object in starting discussions on the divergences noted as long as these remain within the limits of official error, seeing that these discussions with the interested parties are not laid down any more than in the case of geometrical inaccuracies.

If one admits the point of view that legally, the landed property follows the movements started by the working of the mine and that consequently the local situation is more important than the figures of the measurements or the cadastral plan, the importance of a very careful check of the boundaries will be appreciated, the maintenance of which is one of the most important duties of the local managers of the permanent way department.

When the measurements are included in the cadastral plan, they must always be associated with the former points of the plan based on previous measurements. The calculation of the areas according to the measurements surveyed on the ground must be considered as the only authoritative one, whatever may be the result of any other method of determining the areas. In general, one cannot consider the cadastral plan as being incorrect as a result of subsidences of the soil.

The verification of measurements in advance of the revision of the cadastral plan would be greatly facilitated if the cadastral service was in possession of a plan of the subsidences. In the same way a note marked « mine working » or « subsidence of the soil » marked on the revision surveys could be checked from this plan.

The Cadastral service undertakes a revisionary survey in the mining regions without taking into account the possibility of the limits of error being exceeded, solely when the major determination of boundaries and the skeleton maps of measurement have to be prepared.

BIBLIOGRAPHY.

1. NIEMCZYK : Bergschadenkunde (Damage caused by mining). — Glückauf, Essen, 1949.

2. GRAHNER : Die grundstückrechtliche und vermessungstechnische Bedeutung der horizontalen Bodenbewegungen in Bergbaugebieten (The importance from the point of view of the legal position of landed property and the technique of surveying of plans of the horizontal movement of the ground in mining districts). — Thesis, Bonn, 1950.

3. RELLENSMANN : Die Gewährleistung der Betriebssicherheit beim Abbau von Steinkohlen flözen unter Eisenbahnen (Guarantee of safety when working a coalfield situated under a railway line). — Mitteilungen aus dem Markscheidewesen, 1940.

4. HEINEMANN : Der Bergschaden nach preussischem Recht (Damage due to mine working according to Prussian law). — Verlag für Sozialpolitik, Wirtschaft und Statistik Paul Schmidt. Berlin, S. W. 68, 1941.

5. SARNETZKY : Ueber den Einfluss des Bergbaus auf Messungsergebnisse (On the influence of mining work on the results of measurements). — Allgemeine Verm. Nachr., 1911, No. 12, 13 and 15.

[385. (09 .2]

OBITUARY.

Auguste MARGUERAT,

Engineer, Doctor h. c. of the University of Lausanne, Former Manager of the Viège-Zermatt, Gornergrat, Furka Oberalp and Schöllenen Railways.
Former Member of the Permanent Commission of the International Railway Congress Association.

We have learnt with great regret of the death on the 27th November last year, of Mr. Auguste Marguerat, former Manager of the Viège-Zermatt, Gornergrat, Furka-Oberalp and Schöllenen Railways Company, and former member of the Permanent Commission of our Association.

Born in 1880 at Lutry, Auguste Marguerat studied at Lausanne where he obtained his engineering diploma. In 1915, after some excellent work on behalf of the Swiss Federal Railways — especially in connection with the building of the C. F. F. station at Lausanne as well as the Central Station of Bale — he undertook the management of the Viège-Zermatt Company. This change from a large railway system to a small private line was not undertaken without much reflection.

At that time, many new problems were arising, since Switzerland had embarked upon the era of electrification. A great many technical innovations had to be made, so that a combination of scientific knowledge and prudence was required.

The brilliant development of the Viège-Zermatt line marked the beginning of an extremely successful career : the introduction of the winter season to the mountain village lying in the shadow of Mount Cervin meant the electrification of the line, protective works against avalanches and the annexation of the snow fields of the Gornergrat.

A few years after the first world war, Mr. Marguerat saved the Furka-Oberalp line from being abandoned. In 1930, he proceeded with the construction of the Brigue-Viège section and created the « Glacier Train » linking up Zermatt and St. Moritz through some wonderful country. In 1942, he electrified this 100 km (62 miles) long line.

Mr. MARGUERAT retired in 1949, but in recognition of his eminent services, was nominated Administrator of the Viège-Zermatt line.

If Swiss tourism can congratulate itself on having installed on the roof of Europe a railway system that is in no way inferior to any railway system of the plains, as far as safety or the convenience of the timetables are concerned, the merit is due to this Swiss Engineer, who was able to carry through this audacious programme in a period which was very far from being the golden age of the mountain railway with the fabulous balance sheets of other days.

Because of his intelligent and energetic labours and by the inspiration of his personality, Mr. MARGUERAT was a leader in the best sense of the word. His name was and always will be authoritative in the profession he adorned so well, not only on the technical but also on the cultural and tourist plane.

Mr. MARGUERAT was nominated a member of the Permanent Commission of our Association in 1930. In spite of his own absorbing duties, he always took a great interest in the work of the Congress. He took part in the Sessions of Madrid (1930), Cairo (1933) and Paris (1937). At the Lucerne Session in 1947, he was a member of the Committee of Honour and Vice President of the Executive Committee of the Local Swiss Organising Committee. He also attended the Rome Session in 1950 and took part in the Enlarged Meetings of the Permanent Commission at Brussels in 1935 where he was Vice President of the 2nd Section, at Brussels in 1939 and at Lisbon in 1949. He resigned his mandate in 1951. All those of our colleagues who knew him will remember Mr. MARGUERAT with great respect.

We offer his family our sincerest sympathy.

The Executive Committee.

MONTHLY BIBLIOGRAPHY OF RAILWAYS (1)

PUBLISHED UNDER THE SUPERVISION OF

P. GHILAIN,

General Secretary of the Permanent Commission of the Internatioual Railway Congress Association.

(JANUARY 1953)

[016. 385. (02]

I. — BOOKS.

In French.

1952 625 .13 (44 + 45)

ULUC (A.).

Le Mont Cenis, sa route, son tunnel. Contribution à istoire des grandes voies de communications.

Paris (V^{e}), Editeur Hermann & Cie, 6, rue de la rbonne. Un volume in-8° carré (16 × 25 cm) de 0 pages, avec une carte hors-texte. (Prix : 500 fr. fr.)

1952 62 (01

SSOP (H.T.) & HARRIS (F.C.).

Photoélasticité. Traduit de l'anglais par G. Henriot.

Paris, Dunod, éditeur. Un volume (16 × 25 cm) de 2 pages, avec 164 figures. (Prix : 2 350 fr. fr.)

1952 624 (06

Mémoires de l'Association Internationale des Ponts et harpentes. Onzième volume, 1951.

Zurich, publié par le Secrétariat général de l'Assoation, Ecole polytechnique fédérale. Un volume 7 × 24 cm) de IX + 389 pages, illustré. En vente à Librairie Leeman, à Zurich.

1952 721 (02

ONDIN (Ch.).

Aide-Mémoire « Dunod ». Bâtiment. Tomes I et II.

Paris, Dunod, éditeur. Deux volumes cartonnés de 6 et 208 pages, illustrés de 141 et 59 figures. (Prix : 0 fr. fr. par volume.)

1952 385 (08 (675)

FFICE D'EXPLOITATION DES TRANSPORTS COLONIAUX (OTRACO).

Rapport 1951.

Bruxelles, OTRACO, 101, avenue Louise. Une broure (22 × 29 cm) de 46 pages, avec tableaux, graiques, cartes et photos hors texte.

1952 656 .225 & 656 .261

OCIÉTÉ DE CONTROLE ET D'EXPLOITATION DE TRANSPORTS AUXILIAIRES (S.C.E.T.A.).

Les divers modes de transport mixte rail-route. Notice documentation, n° 29. (Supplément au *Bulletin de ocumentation*, n° 35, de mai 1952.)

Paris (VIII^{e}), S.C.E.T.A., 66, rue de Monceau. Une rochure (21 × 27 cm) de 40 pages et 55 illustrations.

1952 385 (08 (493)

SOCIÉTÉ NATIONALE DES CHEMINS DE FER BELGES.

Rapport sur l'exploitation pendant le vingt-cinquième exercice (année 1951).

Bruxelles, édité par la S. N. C. B., 17, rue de Louvain. Un volume (21 × 30 cm) de 412 pages, avec de nombreux tableaux et graphiques.

1952 62 (02

Techniques de l'Ingénieur. 3^{e} partie : *Electrotechnique*, rédigée sous la direction de M. F. BEDEAU.

Paris, Editions *Techniques de l'Ingénieur*, 26, place Dauphine. Deux volumes (25 × 30 cm) de 1 800 pages, avec 3 000 figures. (Prix : 25 600 fr. fr.)

In German.

1952 385 (02

Jahrbuch des Eisenbahnwesens 1952. 3. Jahrgang. Herausgegeben von Berthold STUMPF.

Darmstadt, Carl Röhrig-Verlag oHG, 8, Stephanstrasse. Ein Band DIN A 4, 185 Seiten Text, Kunstdruckpapier, mit 150 Tafeln und Abbildungen. (Preis : D.M. 7.20.)

1952 621 .13 (43)

RADDE (R.).

Die Dampflokomotive im maschinentechnischen Dienst der Deutschen Bundesbahn. Teil II : *Lokomotivbetriebsdienst*

Berlin, Lichterfelde, Verlag Georg Achterberg. Ein Band C 5, 176 Seiten mit 30 Abbildungen. (Preis : D.M. 6.60.)

1952 621 .31

v. RZIHA (E.).

Starkstromtechnik. Herausgegeben von Dr.-Ing. R. GENTHE. 8. völlig neu bearbeitete Auflage. 2. Teil.

Berlin, Verlag von Wilhelm Ernst & Sohn. 315 Seiten mit 369 Abbildungen. (Preis : geh. D.M. 24,—.)

1952 621 .392

SAHLING (B.) & LATZIN (K.).

Die Schweisstechnik des Bauingenieurs. Einführung in Entwurf, Berechnung, Herstellung und Untersuchung von Schweissverbindungen im Stahlbau unter Berücksichtigung der amtlichen Vorschriften. 2. neubearbeitete und erweiterte Auflage.

Braunschweig, Verlag Friedrich Vieweg und Sohn. (Preis : gebunden, D.M. 19.20.)

---

(1) The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress njointly with the Office Bibliographique International, of Brussels, (See « Bibliographical Decimal Classification as applied to Railway cience », by L. WEISSENBRUCH, in the number for November 1897, of the *Bulletin of the International Railway Congress*, p. 1509.)

In English.

1952 385 (09 (42)

BARRIE (D.S.).

The Rhymney Railway.

South Godstone, Surrey : The Oakwood Press. (Price : 6 s. 6 d.)

1952 621 .33

CAHEN (F.).

Problems of power transmission at voltages above 225 kV.

London : British Electrical and Allied Manufacturers Association, 36, Kingsway, W. C. 2. (Price : 5 s. net.)

1952 62

DULL (R.W.).

Mathematics for engineers. Third edition.

London : MacGraw. Hill Publishing Company, Limited, 95, Farringdon Street, E.C. 4. (Price : 64 s.)

1952 725

FISHER CASSIE (W.) & NAPPER (J.H.).

Structure in building.

London : The Architectural Press, 13, Queen Anne's gate, S.W. 1. (Price : 30 s. net.)

1952 691

KOMENDANT (A.E.).

Prestressed concrete structures.

London : MacGraw Hill Publishing Company, Incorporated, 95, Farringdon Street, E.C. 4. (Price : 42 s. 6 d.)

1952 621

POULTNEY (E.C.).

Steam locomotion. Vols. I and II.

London : The Caxton Publishing Co. Ltd., Mor Hall, St. George Street, Hanover Square, W. 1 (9 × 7 × 1 in.), 339 pp. and 333 pp. respectively. Illustra (Price : 61 s. 9 d.)

1952 656

Report to the Minister of Transport upon the Accide which occurred on the Railways of Great Britain dur the year 1951.

London : Her Majesty's Stationery Office. (Pric 2 s. net.)

1952 7

SCOTT (W.B.).

Steelwork in building.

London : E. & F. N. Spon, Limited, 22. Henrie Street, W.C. 2. (Price : 25 s. net.)

1952 6

STEWART (D.A.B.).

High quality concrete.

London : E. & F. N. Spon, Limited, 22, Henrie Street, W.C. 2. (Price : 25 s. net.)

1952 5

The new electrical encyclopaedia. Edited by S. BLAXLAND STUBBS. Four volumes.

London : The Waverley Book Company, Limit 96/97, Farringdon Street, E.C. 4. (Price : £ 8.8.0

In Italian.

1952 6

SANTARELLA (L.).

Prontuario del cemento armato. XIX ediz.

Milano, Ulrico Hoepli, editore. 629 pagine, c 262 figure.

[**016.** 385. (05]

II. — PERIODICALS.

In French.

Annales des ponts et chaussées. (Paris.)

1952 624 .2 & 624 .6

Annales des ponts et chaussées, juillet-août, p. 407.

BLAISE (P.). — Formules élémentaires pour le **calcul des poutres, arcs et portiques à plan moyen.** (8 000 mots, tableaux & fig.)

1952 624

Annales des ponts et chaussées, septembre-octobre, p. 613.

NICOLSKY (V.A.). — Remarques sur le **calcul des ponts larges à poutres multiples solidarisées par les entretoises.** (4 000 mots & fig.)

Annales des Travaux Publics de Belgique. (Bruxelles.)

1952 624 .63 (4

Annales des Travaux publics de Belgique, juin, p. 4

DOYEN (R.). — La **construction du pont de Mor mont en arcs préfabriqués en béton armé.** (2 500 m & fig.).

Bulletin des C.F.F. (Berne.)

1952 656 (4

Bulletin des C.F.F., août-septembre, p. 147.

BRITT (J.). — **Essai d'entente entre le rail et la rou** (2 000 mots.)

1952 625 .24

Bulletin des C.F.F., août-septembre, p. 152.

Les **wagons standard U.I.C.** (1 000 mots & fig.)

952 **621** .336 (494)
lletin des C.F.F., octobre, p. 168.
HILFIKER (H.). — Nouveaux véhicules du **service ntretien des lignes de contact.** (1 000 mots & fig.).

952 **625** .13 (494)
lletin des C.F.F., octobre, p. 171.
THIOUL (Ch.). — **Incendies dans les tunnels** et tes de secours. (1 200 mots.)

Bulletin des Transports Internationaux par Chemins de fer. (Berne.)

952 **385** .62 & **385** .63
ll. des transp. intern. par Chemins de fer, juillet-août, p. 179.
e Session des Commissions préliminaires de **révision la C.I.M. et de la C.I.V.** (3 000 mots.)

952 **385** .6
ll. des transp. intern. par Chemins de fer, juillet-août, p. 187.
HAUSTEIN (W.). — **Conciliation et arbitrage dans domaine ferroviaire international.** (4 000 mots.)

952 **385** .113 (493)
ll. des transp. intern. par Chemins de fer, juillet-août, p. 202.
La **Société Nationale des Chemins de fer belges en 1951.** 000 mots.)

Containers. (Paris.)

1952 **656** .225 & **656** .261
ntainers, nº 7, juin, p. 11.
NICOLAS (P.). — **L'Exposition Internationale des ntainers** de Liège (26 avril-11 mai). (2 000 mots fig.)

1952 **656** .225 & **656** .261
ntainers, nº 7, juin, p. 23.
BIED-CHARRETON (R.). — Un **container frigo-ique.** (1 000 mots & fig.)

1952 **656** .225 (42) & **656** .261 (42)
ntainers, nº 7, juin, p. 27.
Aménagements intérieurs de containers. (500 mots fig.)

Rail et Route. (Paris.)

1952 **656** .222 .5 (73)
il et Route, juillet, p. 3; août, p. 3.
PARABON (F.-C.). — Les **grands express américains.** 000 mots & fig.)

1952 **656** .1 (44) & **656** .2 (44)
il et Route, juillet, p. 11.
Les **autorails Floirat** (autocar Floirat sur rails et sa norque). (1 000 mots & fig.)

1952 **625** .162
Rail et Route, août, p. 18.
ROBERTIN. — La **suppression des passages à niveau** est-elle rentable? (1 000 mots.)

Revue de l'Aluminium. (Paris.)

1952 **624** .8 (44) & **669** .71 (44)
Revue de l'Aluminium, juillet-août, p. 285.
REINHOLD (J.). — Le **platelage en alliage léger du pont basculant** du Havre. (1 500 mots & fig.)

1952 **625** .42 (44) & **669** .71 (44)
Revue de l'Aluminium, juillet-août, p. 291.
VICTOR (M.). — « Franklin D. Roosevelt », la **station de métro en aluminium.** (1 000 mots & fig.)

Revue de l'Association française des Amis des Chemins de fer. (Paris.)

1952 **621** .33 (44)
Revue de l'Association franç. des Amis des Ch. de fer, juillet-août, p. 90.
CAIRE (D.). — **L'exploitation de l'artère Paris-Lyon avant et après l'électrification.** (6 000 mots & fig.)

1952 **621** .335 (44)
Revue de l'Association franç. des Amis des Ch. de fer, juillet-août, p. 103.
CAIRE (D.). — La **locomotive électrique à courant continu 1 500 Volts CC-7 100** étudiée et construite pour la S.N.C.F. par la Société Alsthom. (10 000 mots & fig.)

Revue Générale des Chemins de fer. (Paris.)

1952 **625** .2 (0 (44)
Revue générale des Chemins de fer, août, p. 333.
GASPARD. — La résistance du matériel roulant aux efforts mécaniques. Le **banc de compression de 900 tonnes** de la S.N.C.F. (4 000 mots & fig.)

1952 **656** .213 (44)
Revue générale des Chemins de fer, août, p. 346.
LAFOUGE. — Le **complexe pétrolier** de Berre. (4 500 mots & fig.)

1952 **656** .212.6 (44)
Revue générale des Chemins de fer, août, p. 358.
ROUSSE. — Les **portiques de levage unifiés** à la S.N.C.F. (1 200 mots & fig.)

1952 **385** .113 (44)
Revue générale des Chemins de fer, août, p. 363.
L'exploitation de la S.N.C.F. en 1951 et au cours des années 1948, 1949 et 1950. (1 000 mots & tableaux.)

1952 **625** .232 (493)
Revue générale des Chemins de fer, août, p. 369.
DUFOUR. — Les **nouvelles voitures pour relations internationales** de la Société Nationale des Chemins de fer belges. (1 000 mots & fig.)

1952 **625** .2 (0
Revue générale des Chemins de fer, septembre, p. 377.
PILLEPICH (A.). — **Etude théorique des mouvements verticaux d'une voiture à bogies.** (7 000 mots & fig.)

1952 **621** .431.72 (44)
Revue générale des Chemins de fer, septembre, p. 393.
DESPOUY. — Les **nouveaux autorails de 300 ch** (type unifié). (2 000 mots & fig.)

1952 **625** .27 (44)
Revue générale des Chemins de fer, septembre, p. 400.
ARNAUD (P.) & RABAT. — La **visite des rames de voitures** à la gare de Paris-Austerlitz. (1 000 mots & fig.)

1952 **656** .212.7 (44)
Revue générale des Chemins de fer, septembre, p. 404.
OLIVIER. — La **téléphonie en haut-parleurs dans la reconnaissance des arrivages de détail.** (1 500 mots & fig.)

1952 **385** .62 & **385** .63
Revue générale des Chemins de fer, septembre, p. 410.
DURAND (P.). — La **révision des Conventions internationales** concernant le transport des voyageurs, bagages et marchandises. (Conférence de Lucerne, juin-juillet 1952). (1 500 mots.)

1952 **625** .232 (44)
Revue générale des Chemins de fer, septembre, p. 412.
Voitures pour voyageurs couchés dans les trains de pèlerinage. (300 mots & fig.)

Science et Technique. (Bruxelles.)

1952 **625** .212 (44) & **625** .42 (44)
Science et Technique, n^os^ 3/4, p. 47; n^os^ 5/6, p. 99.
LAMALLE (U.). — Essai sur le Métropolitain de Paris d'une **voiture montée sur pneumatiques.** Mise en expérimentation sur la voie en navette « Porte des Lilas — Pré-Saint-Gervais ». (4 000 mots & fig.)

1952 **62** (01 & **691**
Science et Technique, n^os^ 5/6, p. 95.
ROISIN (V.), SARIBAN (A.) & ZACZEK (S.). — Une nouvelle méthode de **mesure de la résistance des bétons mis en place.** (1 500 mots & fig.)

1952 **625** .1 (493)
Science et Technique, n^os^ 5/6, p. 106.
La **Jonction Nord-Midi.** Quelques aspects nouveaux du problème. (2 000 mots.)

Les Transports publics. (Lausanne.)

1952 **385** .13
Les Transports publics, juillet, p. 3.
Les **charges extra-ferroviaires** de nos chemins de fer. (800 mots.)

1952 **625** .2
Les Transports publics, août, p. 8.
Wagons frigorifiques. (1 000 mots & fig.)

1952 **625** .6 (4
Les Transports publics, septembre, p. 3.
DEVOS. — Les **Chemins de fer privés belges** **défendent.** (1 000 mots.)

Travaux. (Paris.)

1952 **656** .2
Travaux, août, p. 375.
PEIRANI (P.). — Notions générales sur les **gares** **chemin de fer à voyageurs.** (3 000 mots & fig.)

1952 **656** .2
Travaux, août, p. 383.
FLINOIS (A.). — Les **gares maritimes.** (3 000 mo
& fig.)

1952 **62** (01 & **6**
Travaux, septembre, p. 409.
LÉVI (R.). — La **sécurité du béton précontrain**
(6 000 mots & fig.)

1952 **624** .32 (4
Travaux, septembre, p. 417; octobre, p. 471.
POITRAT (R.). — La **reconstruction du pont-rou**
de Strasbourg-Kehl sur le Rhin. (10 000 mots & fig

1952 **721**
Travaux, septembre, p. 436; octobre, p. 491.
CAMBEFORT (H.). — Contribution à l'étude
rabattement des nappes aquifères. (5 000 mots & fig

La Vie du Rail. (Paris.)

1952 **625** .1 (49
La Vie du Rail, 28 juillet, p. 3; 4 et 11 août, p. 4.
FORCE (G.). — La **jonction ferroviaire Nord-Mi**
à Bruxelles. (1 500 mots & fig.)

1952 **625** .13 (49
La Vie du Rail, 18 et 25 août, p. 3; 1^er^ septembre, p.
8 septembre, p. 6.
GASSMANN (W.). — La **ligne du Saint-Gothard**
soixante-dix ans. (3 500 mots & fig.)

1952 **621** .132.8 (44) & **621** .438 (4
La Vie du Rail, 1^er^ septembre, p. 3
Locomotive à turbine alimentée par un générateur
gaz à piston. (1 000 mots & fig.)

1952 **621** .431.72 (46
La Vie du Rail, 22 septembre, p. 6.
Dieselisation des Chemins de fer portugais. (1 20
mots.)

In German.

er Eisenbahningenieur. (Frankfurt a. Main.)

1952 **691**
er Eisenbahningenieur, August, S. 157.
KOBER (K.). — **Spannbeton.** (2 000 Wörter & Abb.)

1952 **656** .254 (43)
er Eisenbahningenieur, August, S. 167.
Verkehrssicherheit an Wegübergängen. (500 Wörter.)

1952 **621** .133.1
er Eisenbahningenieur, August, S. 169.
SCHOREGGE (H.). — **Richtige Ausnutzung der ohle.** (1 500 Wörter & Abb.)

1952 **621** .431.72 (43)
er Eisenbahningenieur, August, S. 171.
HONSEL (A.). — **Neue Schienenomnibusse** im Dienste er Deutschen Bundesbahn. (1 500 Wörter & Abb.)

1952 **621** .9 (43)
er Eisenbahningenieur, September, S. 182.
RIDDER (H.). — Die **Werkzeugmaschine** und ihr insatz bei der Deutschen Bundesbahn. (2 500 Wörter Abb.)

1952 **656** .212
er Eisenbahningenieur, September, S. 186.
PREISIGKE (W.). — Vorschlag zur Bewirtschaftung nd **Unterhaltung der Elektrokarren und deren Batterien.** 2 000 Wörter & Abb.)

1952 **625** .173
Der Eisenbahningenieur, September, S. 191.
WEIG (J.) & GASSER (W.). — **Mechanisierung im leisbau.** (5 000 Wörter & Abb.)

1952 **625** .151
Der Eisenbahningenieur, September, S. 197.
GEHRING (S.). — Über die Anforderung von **erzstücken für Bogenweichen, Bogenkreuzungen und ogenkreuzungsweichen.** (1 500 Wörter & Abb.)

1952 **625** .113
Der Eisenbahningenieur, September, S. 200.
VOGEL (G.). — Die **Klotoide in ihrer Anwendung.** 2 000 Wörter & Abb.)

E.T.R. Eisenbahntechnische Rundschau. (Köln-Darmstadt.)

1952 **621** .431.72 (43)
isenbahntechnische Rundschau, August, S. 259.
GAEBLER (G.-A.). — Zur **Entwicklung der Diesel-okomotiven der Deutschen Bundesbahn** nach dem Kriege nter besonderer Berücksichtigung der Neubaureihe V 80. (12 000 Wörter & Abb.)

1952 **662**
Eisenbahntechnische Rundschau, August, S. 279.
MAYR (F.). — Das **Kraftstoff-Problem bei einer Verdieselung des Schienenverkehrs.** (4 500 Wörter & Abb.)

1952 **625** .18 (43) & **625** .27 (43)
Eisenbahntechnische Rundschau, August, S. 285.
JESSEN (H.). — Die **Verwendung von Kunststoffen im Eisenbahnwesen.** (3 000 Wörter.)

1952 **656** .211 (43) & **656** .25 (43)
Archiv für Eisenbahntechnik, Folge 1, E.T.R., Juli, S. 3.
GOTTSCHALK (P.). — Die **betriebliche Leistungsfähigkeit der Hohenzollernbrücke in Köln.** (5 000 Wörter & Abb.)

1952 **625** .2 (01
Archiv für Eisenbahntechnik, Folge 1, E.T.R., Juli, S. 11.
POPP (C.). — Über die **Stosswirkungen unrunder Eisenbahnräder.** (8 000 Wörter & Abb.)

1952 **625** .143 & **625** .2
Archiv für Eisenbahntechnik, Folge 1, E.T.R., Juli, S. 28.
RUBIN (H.). — Beitrag zur Frage der **Schienenspannungen infolge unrunder Räder.** (2 000 Wörter & Abb.)

1952 **625** .15
Archiv für Eisenbahntechnik, Folge 1, E.T.R., Juli, S. 32.
HARTMANN (F.). — Grundlagen der Konstruktion und der Weiterentwicklung von **Weichen und Gleisverbindungen.** (8 000 Wörter & Abb.)

Elektrische Bahnen. (München.)

1952 **621** .135.4 & **625** .215
Elektrische Bahnen, Juli, S. 149.
HEUMANN (H.). — **Grundzüge der Führung der Schienenfahrzeuge.** *(Fortsetzung.)* (7 000 Wörter & Abb).

1952 **621** .336 (43)
Elektrische Bahnen, Juli, S. 163.
WAGNER (R.). — **Fahrleitungsisolatoren.** (1 000 Wörter & Abb.)

Glasers Annalen. (Berlin.)

1952 **621** .335 (43)
Glasers Annalen, September, S. 195.
OHL (W.). — **Neue elektrische Lokomotive für Einphasen-Wechselstrom 50 Hz.** (2 000 Wörter & Abb.)

1952 **625** .212
Glasers Annalen, September, S. 199.
KÖNIG (H.). — **Oberflächenbearbeitung und Oberflächengüte hochbeanspruchter Wagenradsätze.** (6 000 Wörter & Abb.)

1952 **625** .24 & **669**

Glasers Annalen, September, S. 206.

FABRY (Ch. W.). — **Leichtbauprobleme** und ihre statische Erfassung im **Waggonbau.** (3 000 Wörter & Abb.)

Internationales Archiv für Verkehrswesen. (Frankfurt-Main.)

1952 **659**

Intern. Archiv. f. Verkehrswesen, Nr 15, 1. Augustheft, S. 359.

HAENICKE (W.). — Die **grossen Verkehrsgesellschaften in der öffentlichen Meinung.** Pflege der « **Public Relations** » als wesentliches Gebot neben der Werbung. (4 000 Wörter.)

1952 **656** (43)

Intern. Archiv. f. Verkehrswesen, Nr 16, 2. Augustheft, S. 377.

BRANDT (L.). — **Gesichtspunkte deutscher Verkehrspolitik.** (7 000 Wörter.)

1952 **625** .3

Intern. Archiv. f. Verkehrswesen, Nr 16, 2. Augustheft, S. 394.

Dr. Ing. BÄSELER. — Die **einschienige Hochbahn** und ihre Verwandten. (1 200 Wörter.)

1952 **385** (09 (56)

Intern. Archiv. f. Verkehrswesen, Nr 16, 2. Augustheft, S. 396.

Die **Eisenbahnen im Irak.** (1 000 Wörter & Karte.)

Schweizerisches Archiv für Verkehrswissenschaft und Verkehrspolitik. (Zürich.)

1952 **656** (43)

Schweizerisches Archiv für Verkehrswissenschaft und Verkehrspolitik, Nr 3, S. 205.

Die deutsche Industrie zum **Koordinationsproblem.** (5 000 Wörter.)

1952 **385** (09 (57)

Schweizerisches Archiv für Verkehrswissenschaft und Verkehrspolitik, Nr 3, S. 221.

HAUSTEIN (W.). — Die **Mandschurischen Eisenbahnen.** Die Entwicklung von der autonomen Eisenbahnzone zur selbständigen Unternehmung. (5 000 Wörter & Karten.)

1952 **656**

Schweizerisches Archiv für Verkehrswissenschaft und Verkehrspolitik, Nr 3, S. 234.

MEYER (H. R.). — **Entwicklung und Organisation des internationalen Verkehrs.** (10 000 Wörter.)

In English.

Bulletin — American Railway Engineering Association. (Chicago.)

1952 **62** (0

Bulletin — American Railway Engineering Association June-July, p. 1.

Rigid frame analysis for members of variable momen of inertia. (173 pages with tables & figs.)

The Engineer. (London.)

1952 **69**

The Engineer, August 29, p. 278.

SMITH (E.E.). — **Density measurement of concret slabs** using gamma radiation. (3 800 words & figs.

1952 **625** .2

The Engineer, September 26, p. 428.

COCK (C.M.). — **Motive power for railways.** (3 80 words & figs.)

1952 **621** .438 (42

The Engineer, October 3, p. 444.

LIVESAY (E.). — **A gas turbine electric experience** (5 600 words & figs.)

1952 **656** .254 (42

The Engineer, October 10, p. 485.

Resignalling at Euston. (4 000 words & figs.)

Engineering. (London.)

1952 **621** .438 (42

Engineering, May 23, p. 664.

Tests of the **Brown-Boveri gas-turbine locomotive** (2 000 words, tables & figs.)

1952 **621** .132.6 (42

Engineering, May 30, p. 698.

2-6-2 tank locomotives : British Railways. (800 word & fig.)

1952 **656** .212.8 (42

Engineering, June 20, p. 795.

Wagon marshalling machine. (400 words & fig.)

1952 **621** .131.3 (42

Engineering, July 4, p. 25.

Locomotive testing at Swindon. (3 000 words & figs.

1952 **621** .132 .8 (931) & **621** .133 .1 (931

Engineering, July 18, p. 89.

4-8-2 oil-burning locomotives for New Zealand. (1 20 words & fig.)

roceedings of the Institution of Civil Engineers. (London.)

1952 **625** .113 (42)
roceedings of the Institution of Civil Engineers, Part II, October, p. 503.
LOACH (J.C.) & MAYCOCK (M.G.). — **Recent velopments in railway curve designs.** (73 pages, illus- ated.)

The Journal of the Institute of Transport. (London.)

1952 **656**
he Journal of the Institute of Transport, September, p. 432.
ROBBINS (R.M.). — **Administration in transport.** 400 words.)

The Locomotive. (London.)

1952 **621** .438
he Locomotive, August 15, p. 119.
Power-gas locomotives. (1 100 words.)

1952 **621** .132.8 (944)
he Locomotive, September, p. 137.
255 ton British-built locomotives for New South Wales. 300 words & figs.)

Journal and Report of proceedings The Permanent Way Institution. (London.)

1952 **625** .17
ournal, The Permanent Way Institution, August, p. 115.
HUMBERSTONE (F.). — **Maintenance and renewals f track in tropical Africa.** (3 600 words.)

Mechanical Engineering. (New York.)

1952 **621** .438
echanical Engineering, August, p. 627.
HAGUE (F.T.). — **The pattern of gas-turbine development.** (4 500 words & figs.)

Modern Transport. (London.)

1952 **656** .212.7 (42)
odern Transport, August 9, p. 3; August 16, p. 11.
A modernised railway goods shed. (2 200 words & figs.)

1952 **656** .225 (42) & **656** .261 (42)
odern Transport, August 9, p. 9.
Door-to-door transport (Railway methods). *(Continued.)* 0 words.)

1952 **621** .132.8 (45)
Modern Transport, August 23, p. 3.
Franco-Crosti boiler. (1 500 words & figs.)

1952 **656** .1 (41) & **656** .2 (41)
Modern Transport, August 23, p. 8; September 20, p. 16.
Transport in Leinster and Ulster. **Rail and road facilities on G.N.R.** (3 900 words & figs.)

1952 **656** .23 (42)
Modern Transport, August 30, p. 5; September 6, p. 11.
OSBORNE MANCE (Sir H.). — A logical alternative to the transport bill. (4 200 words.)

The Oil Engine and Gas Turbine. (London.)

1952 **621** .431.72 (42)
The Oil Engine, August, p. 130.
Standardized double-bogie locomotive design. (1 800 words & figs.)

1952 **621** .431.72
The Oil Engine, August, p. 138.
New mechanical-hydraulic railway transmission. (900 words & figs.)

1952 **621** .431.72 (44)
The Oil Engine, August, p. 144.
A 1 000 B.H.P. locomotive of French design. (1 600 words & figs.)

Railway Age. (New York.)

1952 **621** .131.3 (73) & **621** .431.72 (73)
Railway Age, July 14, p. 71.
« **Treadmills** » **test locomotives.** (1 600 words & figs.)

1952 **656** .254 (73)
Railway Age, July 21, p. 39.
Trains run in either direction on both tracks with new ACL installation of C.T.C. (1 400 words & figs.)

1952 **625** .162 (73) & **656** .254 (73)
Railway Age, July 28, p. 35.
Reflectorized crossbrick signs... (2 000 words & figs.)

1952 **621** .438 (42)
Railway Age, July 28, p. 38.
POULTNEY (E.C.). — **A coal-fired gas-turbine locomotive for British Railways.** (500 words & figs.)

1952 **625** .234 (73)
Railway Age, August 18, p. 46.
C. and N.W. develops mobile steam plant. (1 200 words & figs.)

1952 **625** .24 (73)
Railway Age, August 25, p. 42.
Can freight cars be protected against higher impacts? (3 000 words & figs.)

1952 **656** .254 (73)
Railway Age, August 25, p. 48.
SAGERT (H.T.). — **On the Rock Island... How radio aids construction forces.** (1 000 words & figs.)

1952 **656** .225 (73)
Railway Age, August 4, p. 69; September 1, p. 83.
RIBE (A.M.). — **Making L.C.L. pay its way.** (Parts I and II.) (5 000 words & figs.)

1952 **621** .33 (492)
Railway Age, September 1, p. 101.
How Holland has rebuilt its electrification. (5 000 words & figs.)

Railway Engineering and Maintenance. (Chicago.)

1952 **691**
Railway Engineering and Maintenance, May, p. 490.
PARIS (G.H.). — **Durable concrete costs less.** (1 500 words & figs.)

1952 **625** .172 (73)
Railway Engineering and Maintenance, Sept., p. 863.
Milwaukee road uses **innovations in rail-laying practice.** (1 800 words & figs.)

The Railway Gazette. (London.)

1952 **621** .438 (42)
The Railway Gazette, July 25, p. 94.
British developments in gas turbines. (600 words & figs.)

1952 **656** .281 (42)
The Railway Gazette, July 25, p. 97; August 1, p. 123.
Locomotive rerailing after the Weedom accident. 1-2. (5 600 words & figs.)

1952 **656** .212 (42)
The Railway Gazette, August 8, p. 152.
Mechanisation at Temple Meads Goods station. (2 200 words & figs.)

1952 **621** .335 (44)
The Railway Gazette, August 8, p. 156.
Motor coach stock for 50-cycle operation. (1 200 words & figs.)

1952 **621** .335 (492)
The Railway Gazette, August 8, p. 157.
New Co-Co locomotives for Netherlands Railways. (1 300 words & figs.)

Diesel Railway Traction. (London.)

1952 **621** .431.72 (4
Diesel Railway Traction, September, p. 223.
Diesel traction in Greece. (5 000 words & figs.)

1952 **621** .4
Diesel Railway Traction, September, p. 229.
KOFFMAN (J.L.). — **Cooling of engine oil.** (4 0
words & figs.)

1952 **621** .431.
Diesel Railway Traction, October, p. 255.
The early history of electric transmission contr
(1 800 words & figs.)

1952 **621** .431.
Diesel Railway Traction, October, p. 259.
KOFFMAN (J.L.). — **The Diesel rail bus.** (3 6
words & figs.)

1952 **625** .
Diesel Railway Traction, October, p. 265.
The anti-slip brake. (1 200 words & figs.)

Railway Mechanical and Electrical Engineer (New York.)

1952 **621** .431.72 (
Railway Mechanical and Electrical Engineer, Augu
p. 83.
WESTERHEIDE (J.R.). — **Throttle control of tract**
force. (900 words & figs.)

1952 **621** .431.72 (
Railway Mechanical and Electrical Engineer, Septemb
p. 63.
WHITTAKER (C.C.) & HUTCHISON (W.M.).
Ignitron locomotive turn in good performance recor
(2 000 words & figs.)

1952 **621** .
Railway Mechanical and Electrical Engineer, Septemb
p. 70.
McDONALD (G.R.). — **Ground relay protecti**
(3 000 words & figs.)

1952 **621** .431.
Railway Mechanical and Electrical Engineer, Septemb
p. 92.
WESTON (E.H.). — **How to tonnage Diesels into**
few groups. (2 800 words & figs.)

Railway Steel Topics. (Sheffield.)

1952 **625** .14
Railway Steel Topics, Vol. I, No. 3, p. 12.
SIMS (A.M.). — **Some notes on standard specificati**
for rails and fishplates. (2 600 words & tables.)

In Spanish.

Ferrocarriles y Tranvias. (Madrid.)

1952 **656** (460)
rrocarriles y Tranvias, agosto, p. 286.
NAVARRO GIL (L.). — La **competencia entre los** **nsportes.** (1 500 palabras.)

1952 **625** .23 (43)
rrocarriles y Tranvias, agosto, p. 288.
HAMACHER HENSE (F.W.). — **Nuevos coches** **ificados** de los Ferrocarriles Federales Alemanes. 500 palabras & fig.)

1952 **621** .431.72 (496 + 56)
rrocarriles y Tranvias, septiembre, p. 321.
HAMACHER HENSE (F.W.). — Los **nuevos trenes** **tomotores** para los Ferrocarriles del Estado turco. 200 palabras & fig.)

Hormigón elastico. (Buenos Aires.)

1952 **691** (494)
ormigón elastico, agosto, p. 7.
BIRKENMAIER (M.), BRANDESTINI (A.) & OŠ (M.R.). — Sobre el desarrollo del **hormigón** **stico** en Suiza. (3 000 palabras & fig.)

1952 **62** (01 & 691
ormigón elastico, agosto, p. 18.
DEVIS (C.E.). — **Calculo a la flexión del hormigón** **stico.** (1 500 palabras & fig.)

In Italian.

Giornale del Genio civile. (Roma.)

1952 **624** .63 (45)
ornale del Genio civile, luglio-agosto, p. 375.
RINALDI (G.). — **Il ponte** in **cemento armato pre-** **mpresso** sull' Idice a Castenaso. (3 000 parole & fig.)

1952 **624** .2
ornale del Genio civile, luglio-agosto, p. 387.
FRANCIOSI (V.). — Sul **calcolo a rottura delle** **utture monodimensionali** in **regime elasto-plastico.** 000 parole & fig.)

1952 **624** .2
ornale del Genio civile, luglio-agosto, p. 401.
PAGANO (M.). — Sul **calcolo di un sistema elastico** **ntinuo costituito da elementi spingenti, ad appoggi** **ermedii scorrevoli.** (3 500 parole & fig.)

Ingegneria ferroviaria. (Roma.)

1952 **625** .14
Ingegneria ferroviaria, luglio-agosto, p. 513.
STABILINI (L.). — Sullo studio sperimentale dell' **inflessione laterale delle rotaie.** (5 000 parole & fig.)

1952 **656** .1 & **656** .2
Ingegneria ferroviaria, luglio-agosto, p. 523.
MATERNINI (M.). — Per una **distribuzione più conveniente del traffico fra strade ordinarie e strade ferrate.** (4 000 parole.)

1952 **621** .332
Ingegneria ferroviaria, luglio-agosto, p. 533.
CARLUCCI (V.). — Metodo rapido per il **calcolo delle frecce e delle tensioni meccaniche dei conduttori delle linee elettriche aeree.** (2 000 parole & fig.)

1952 **621** .335 (45)
Ingegneria ferroviaria, luglio-agosto, p. 538.
GIAGNONI (C.). — Analisi degli **inconvenienti di esercizio con le locomotive elettriche** della rete ferroviaria di Stato. (3 000 parole & fig.)

1952 **621** .331 (45)
Ingegneria ferroviaria, luglio-agosto, p. 543.
SAVIO (E.). — Il contributo delle Ferrovie dello Stato agli **scambi di energia elettrica nel periodo post-bellico e considerazioni sui vettoriamenti di energia.** (3 000 parole & fig.)

1952 **659**
Ingegneria ferroviaria, luglio-agosto, p. 549.
ARMANDO (L.). — La **publicità dei servizi ferroviari.** (3 000 parole.)

Politica dei Trasporti. (Roma.)

1952 **656** (4)
Politica dei Trasporti, nº 15, luglio-agosto, p. 304.
SANTORO (F.). — **I trasporti e l'unità europea.** (3 500 parole.)

1952 **625** .28 & **656** .27
Politica dei Trasporti, nº 16, settembre, p. 369.
MEMMI (V.). — **Particolare sviluppo delle automotrici sulle linee ferroviarie secondarie.** (2 500 parole & fig.)

1952 **625** .42
Politica dei Trasporti, nº 16, settembre, p. 382.
Metropolitane e loro limite di convenienza. (1 600 parole & fig.)

1952 **621** .335 : **625** .42 (45)
Politica dei Trasporti, nº 16, settembre, p. 392.
Il **materiale rotabile** per la **Metropolitana** di Roma. (1 000 parole & fig.)

In Netherlands.

De Ingenieur. ('s Gravenhage.)

1951 **62** (01 & **691**

De Ingenieur, n^{r} 49, 7 December, p. Bt. 81.

COEPIJN (W. C.). — De **breukzekerheid in doorsneden van gewapend-beton en van gespannen beton.** (4 000 woorden & fig.)

1952 **621** .33

De Ingenieur, n^{r} 3, 18 Januari, p. V. 1.

KOSTER (J. P.). — **Electrische tractie met eenphase wisselstroom 50 perioden.** (7 000 woorden & fig.)

1952 **624** .2 & **691**

De Ingenieur, n^{r} 4, 25 Januari, p. Bt. 1; n^{r} 7, 15 Februari, p. Bt. 13.

HAAS (A.M.). — Experimenteel onderzoek van **voorgespannen betonbalken.** (4 000 woorden & fig.)

1952 **624** .2 & **691**

De Ingenieur, n^{r} 21, 23 Mei, p. Bt. 29; n^{r} 23, 6 Juni, p. Bt. 37.

GUYON (Y). — Quelques problèmes des **constructions hyperstatiques précontraintes par câbles.** (5 000 woorden & fig.)

Spoor- en Tramwegen. (Utrecht.)

1952 **725** .31 (4

Spoor- en Tramwegen, n^{r} 19, 18 September, p. 3

SCHELLING (H.G.J.). — Het **nieuwe statio gebouw te Zutphen.** (1 500 woorden & fig.)

1952 **656** .211 (4

Spoor- en Tramwegen, n^{r} 21, 16 October, p. 339.

BRINKHORST (H. J.). — Het **nieuwe station Arnhem.** (2 500 woorden & fig.)

1952 **625** .1 (4

Spoor- en Tramwegen, n^{r} 21, 16 October, p. 345.

JACOPS (A.). — De **Noord-Zuid verbinding te Bru** voor het verkeer geopend. (1 500 woorden & fig.)

1952 **656** (

Spoor- en Tramwegen, n^{r} 21, 16 October, p. 349.

BETLEM (H. P. B.). — Regeringsvoorstellen voor **Britse Verkeerswezen.** (3 000 woorden.)

M. Weissenbruch & Co., Ltd., Printer to the King, 49, rue du Poinçon, Bruxelles.

MONTHLY BIBLIOGRAPHY OF RAILWAYS(1)

PUBLISHED UNDER THE SUPERVISION OF

P. GHILAIN,

General Secretary of the Permanent Commission of the International Railway Congress Association.

(FEBRUARY 1953)

016. 385. (02]

I. — BOOKS.

In French.

952 721 .9
DSON (F.).
Acier, fer, fonte, dans le bâtiment.
Bruxelles, édité par le Centre belgo-luxembourgeois
nformation de l'Acier, 154, avenue Louise. Un
ume (21 × 26 cm) de 122 pages, avec 236 figures.

952 621 .3
UILLÉ (A).
Electrotechnique à l'usage des ingénieurs. Tome II :
chines électriques. 3e édition.
Paris, Dunod, éditeur. Un volume (16 × 25 cm)
400 pages, avec 554 figures. (Prix : 1 280 fr. fr.)

952 624 .92
STIN (E.).
es charpentes métalliques.
Paris, Eyrolles, éditeur. Un volume (16 × 25 cm)
242 pages, avec 384 figures. (Prix : 2 000 fr. fr.)

952 62 (02
Hütte, Manuel de l'Ingénieur. Tome III. Première
tie. — Statique des constructions. — Principes de
construction. — Construction des ponts.
Paris, Librairie Béranger, éditeur. Un volume (12
19 cm) de 512 pages, avec 829 figures. (Prix, relié :
50 fr. fr.)

1952 621 .8
MASSON (G.) & TOURANCHEAU (A.L.).
Eléments de construction à l'usage de l'ingénieur.
me VIII : *Appareils de levage et de manutention*
canique.
Paris, Dunod, éditeur. Un volume (16 × 25 cm) de
6 pages, avec 305 figures. (Prix : 620 fr. fr.)

1952 691
SQUER (J.).
L'exécution du béton sur les chantiers.
Paris, Gauthier-Villars, éditeur. Un volume (13 × 21
) de 244 pages, avec 15 figures et 2 abaques. (Prix :
0 fr. fr.)

1952 621 .33 & 621 .431.72
TIN (P.C.).
La traction électrique et Diesel-électrique.
Paris, Librairie Eyrolles, éditeur. Un volume de
0 pages, 173 figures et 58 planches. En annexe, les
ractéristiques principales de huit locomotives modernes.

In German.

1952 621 .438
KRUSCHIK (J.).
Die Gasturbine.

Wien I : Springer-Verlag, Mölkerbastel, 5. (Preis : 107 sch.)

1952 385 (43)
SARTER (Dr. jur. A.) & KITTEL (Prof. Dr. jur. Th.).
Die Deutsche Bundesbahn.

Frankfurt am Main, Verkehrswissenschaftliche Lehrmittelgesellschaft m.b.H. — Ein Band, DIN A 5, XII/316 Seiten. (Preis : Gzln. DM. 16.—.)

1950 621 .31
SCHILLING (Dr. Ing. habil. W.).
Stromrichtertechnik.

München, Verlag von R. Oldenbourg. Ein Band Gr.-8°, 144 Seiten mit 144 Bildern und 1 Tafel. (Preis : kart., D.M. 14.80.)

1952 625 .1 (02
Taschenbuch für den Eisenbahn-Vermessungsdienst. 4. verbesserte Auflage.

Bearbeitet und herausgegeben von der Deutschen Bundesbahn, Eisenbahndirektion Hannover. Kartoniert Din A 6h. 196 Seiten mit einer grossen Tafel, zahlreichen Abbildungen, Formeln und Zusammenstellungen. (Preis : D.M. 3.50.)

In English.

1952 691
ABELES (P.W.).
Principles and practice of prestressed concrete. 2nd edition Vol. 1.

London : Crosby Lockwood, Publishers. (Price : 21 s.)

1952 621 .132.1 (09
AHRONS (E.L.).
Locomotive and train working in the latter part of the Nineteenth Century. Vol. 3. Reprinted from the Railway Magazine.

Cambridge : W. Heffer & Sons Ltd. One volume (9 × 6 in.) 113 pp. + 24 pp. of illustrations. (Price : 15 s.)

---

(1) The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress
jointly with the Office Bibliographique International, of Brussels. (See « Bibliographical Decimal Classification as applied to Railway
ence », by L. WEISSENBRUCH, in the number for November 1897, of the *Bulletin of the International Railway Congress*, p. 1509.)

1952 **385** (09

FREEMAN (G.).

Railways the World Over.

Allen, Hampton Court, Middlesex: Jan Allan Limited, Craven House. (11 1/4 × 8 3/4 in.), 128 pp. Fully illustrated. (Price : 12 s. 6 d.)

1952 **62** (01 & **691**

MANNING (G.P.).

The displacement method of frame analysis.

London : Concrete Publications Limited. One volume of 120 pages, 88 figs, 195 tables. (Price in Great Britain: 9 s. o d.)

1952 **385** (09

Overseas Railways, 1952.

London S.W. 1 : The Railway Gazette, 33, Tothill Street.

A publication (11 1/2 × 8 1/2 in.) of 128 pages. Fully illustrated. Paper covers. (Price : 7 s. 6 d.)

1952 **62**

SEELYE (Elwyn E.).

Data Book for Civil Engineers.

Vol. I. — « Design », 521 pages, numerous illustrations and tables. (Price in U.S.A. : 10.00 $)

Vol. II. — « Specifications and Costs », 506 pages, numerous illustrations and tables. (Price in U.S.A

13.00 $)

2nd edition 1951.

New York : John Wiley & Sons, Inc.;
London : Chapman & Hall Ltd.

1952 **537** & **621** .

TIMBIE (W.H.), VANNEVAP-BUSH and HOADL (G.).

Principles of electrical engineering. Fourth edition.

London : Chapman and Hall Limited, 37, Es Street, W.C. 2. (Price : 52 s. net.)

1952 **385** (09 (4

WHITEHEAD (R.A.) and SIMPSON (F.D.).

The story of the Colne Valley.

Essex : Francis Ridgway, Limited, 71c, High Stre Brentwood. (Price : 12 s. 6 d.)

In Spanish.

1951

TORROJA (E..)

Lecciones elementales de elasticidad con aplicación la tecnica de la construcción.

Madrid : Editional Dossat, S.A., Plaza de San Ana, 9. Uno volumen (18 × 25 cm) de 310 p. c 195 figuras.

[**016.** 385. (05]

II. — PERIODICALS.

In French.

Bulletin des transports internationaux par chemins de fer. (Berne.)

1952 **656** .223.2

Bull. des transp. intern. par Chemins de fer, septembre, p. 216.

DESBIOLLES (R.). — La question des droits réels, et en particulier des droits de gage, sur des **wagons de particuliers.** (2 000 mots.)

1952 **385** .13

Bull. des transp. intern. par Chemins de fer, septembre, p. 238.

Les **charges extra-ferroviaires** des Chemins de fer. (600 mots.)

Bulletin de l'Union internationale des Chemins de fer. (Paris.)

1952 **659**

Bulletin de l'Union intern. des Ch. de fer, septembre-octobre, p. 200.

Les orientations du C.I.C.E. pour la **campagne de « public relations »** des Administrations-membres. (2 000 mots.)

Economie et Technique des Transports. (Zurich.)

1952 **625** .214 (49

Economie et Technique des Transports, n° 4-6, p. 4 n° 7-9, p. 76.

METTAUER (G.). — **Rollenachslager der norma spurigen Personen- und Güterwagen** der SBB. (2 5 mots & fig.)

1952 **621** .335 (49

Economie et Technique des Transports, n° 4-6, p. 4

JOSS (F.). — **Modernisierung** der St. Gallen-Speiche Trogen- Bahn. (1 600 mots & fig.) (Texte français pa dans le n° 7-9 [1952], p. 68-75.)

1952 **385** .

Economie et Technique des Transports, n° 7-9, p. 8

HUG (Ad.-M.). — De quelques particularités q influencent l'**économie de l'exploitation de chemins de fe** *(Suite.)* (1 200 mots & fig.)

Génie Civil. (Paris.)

1952 **621** .33 (4

Génie Civil, n° 3332, 1er septembre, p. 321.

DUMAS (J.). — **L'inauguration de la traction éle trique** sur la ligne Paris-Lyon de la S.N.C.F. (24 ju 1952). (6 000 mots & fig.)

952 **621** .132.8 (44) & **621** .438 (44)
ie Civil, nº 3335, 15 octobre, p. 390.
a **locomotive Renault à turbine à gaz et générateur istons libres.** (2 000 mots & fig.)

952 **691**
ie Civil, nº 3335, 15 octobre, p. 393.
OÜARD (A.). — **Le béton tendu et sa fissuration s les poutres rectangulaires.** (1 000 mots.)

L'Ossature métallique. (Bruxelles.)

952 **621** .392 (44) & **624** (44)
ssature métallique, octobre, p. 459.
LOSBACH (R.).— La **reconstruction du pont Corneille Rouen.** (3 000 mots & fig.)

952 **625** .244
ssature métallique, octobre, p. 484.
NICAISE (A.).— Construction de **wagons frigorifiques.** 00 mots & fig.)

952 **625** .245 (493)
ssature métallique, octobre, p. 500.
Wagons-trémies pour le transport du ciment en vrac. 0 mots & fig.)

Rail et Traction. (Bruxelles.)

952 **621** .33 (44)
l et Traction, octobre-novembre, p. 1.
L'**électrification** de Paris-Lyon. (3 500 mots & fig.)

evue Générale des Chemins de fer. (Paris.)

952 **656** .213 (44)
vue générale des Chemins de fer, octobre, p. 421.
LATRON (J.). — La **Porte océane.** (4 000 mots & fig.)

952 **385** .57 (44)
vue générale des Chemins de fer, octobre, p. 433.
PARÈS (R.) & RENAULT (A.). — Le **fichier central personnel** de la S.N.C.F. (1 000 mots & fig.)

952 **656** .281
vue générale des Chemins de fer, octobre, p. 442.
CHARTET. — La **théorie statique du déraillement n essieu.** (*Suite.*) (7 000 mots & fig.)

952 **651** (44)
vue générale des Chemins de fer, octobre, p. 454.
CRÉANCY. — Le **microfilm** et son utilisation dans bureaux d'études. (1 500 mots & fig.)

Revue générale de Mécanique. (Paris.)

952 **621** .392 (73)
vue générale de Mécanique, septembre, p. 297.
Le **soudage** aux Etats-Unis. (1 500 mots.)

Revue technique Sulzer. (Winterthur.)

952 **621** .431.72 (593)
vue technique Sulzer, nº 3, p. 15.
Locomotives Diesel à transmission électrique A1A-A1A 960 ch pour les Chemins de fer de l'Etat siamois. 000 mots & fig.)

La Technique Moderne. (Paris.)

1952 **621** .132.3 (44)
La Technique Moderne, août, p. 241.
PELLEVAT (A.). — La **locomotive 242 A-1** de la S.N.C.F. (1 500 mots & fig.)

Trains. (Bruxelles.)

1952 **725** .33 (493)
Trains, nº 8, p. 1.
LENFANT (H.). — La **reconstruction des remises aux locomotives** de la S.N.C.B. (4 000 mots & fig.)

1952 **656** .225 & **656** .261
Trains, nº 8, p. 17.
FIERS (J.). — La **technique du porte à porte** et l'Exposition internationale des Containers, à Liège. (1 500 mots & fig.)

1952 **621** .33 (44), **621** .335 (44) & **625** .1 (44)
Trains, nº 9, p. 3; p. 7; p. 15; p. 20.
VAUBOURDOLLE (R.). — L'**électrification** Paris-Lyon. (1 500 mots & fig.)
WALTER (J.). — Caractéristiques principales des **installations électriques de la voie** sur Paris-Lyon. Les caténaires. La signalisation. Les télécommunications. (3 000 mots & fig.)
GARREAU. — L'électrification de la ligne Paris-Lyon. L'**alimentation en énergie** (lignes à haute tension et sous-stations). (1 500 mots & fig.)
Les **locomotives** et **automotrices.** (1 000 mots & fig.)
BRASSEUR. — Les **travaux de génie civil** sur la ligne de Paris-Lyon. (1 200 mots & fig.)
MARTIN (C.). — **Adaptation à la traction électrique du personnel, du matériel** et des **installations** du Service du Matériel et de Traction du Sud-Est. (4 000 mots & fig.)

Travaux. (Paris.)

1952 **624** (44) & **691** (44)
Travaux, octobre, p. 479; novembre, p. 512.
DUMAS (F.). — **L'évolution de la précontrainte du béton armé au cours de la reconstruction des ouvrages d'art** du Nord et du Pas-de-Calais *(suite)*. (5 000 mots, tableaux & fig.)

1952 **62** (01
Travaux, octobre, p. 487; novembre, p. 532.
MALLET (Ch.). — Sur la **théorie de la déformation permanente et de la rupture.** (6 000 mots & fig.)

La Vie du Rail. (Paris.)

1952 **625** .13 (436)
La Vie du Rail, 29 septembre, p. 3; 6 octobre, p. 10.
SCHMIDT (G.). — Le **nouveau tunnel du Semmering** (Autriche). (3 000 mots & fig.)

1952 **656** .222.6 (44) & **656** .225 (44)
La Vie du Rail, 6 octobre, p. 3; 13 octobre, p. 8; 20 octobre, p. 6.
BONDON (G.). — Le **Service marchandises** de la S.N.C.F. (5 000 mots & fig.)

1952 **625** .3 (43)
La Vie du Rail, 27 octobre, p. 8.
Essai d'un **chemin de fer monorail** en Allemagne. (350 mots & fig.)

In German.

Der Eisenbahningenieur. (Frankfurt a. Main.)

1952 **621** .9 (43) & **625** .26 (43)

Der Eisenbahningenieur, Oktober, S. 208.

GLÖCKNER (K.). — **Werkzeugmaschinen für Achsschenkelbearbeitung** bei der Deutschen Bundesbahn. (3 000 Wörter & Abb.)

1952 **621** .13

Der Eisenbahningenieur, Oktober, S. 214.

LORENZ (R.). — **Wo sitzt die Achillesferse der Dampflok?** (1 000 Wörter.)

1952 **721** (43)

Der Eisenbahningenieur, Oktober, S. 215.

ROTHFUCHS. — **Neue Baubestimmungen im Wohnungsbau** zur Baukostensenkung. (3 000 Wörter.)

1952 **656** .257

Der Eisenbahningenieur, Oktober, S. 220.

SCHÜTZ (H.). — **Gleisbildstellwerke** auch auf kleinen Bahnhöfen. (1 200 Wörter & Abb.)

1952 **625** .17

Der Eisenbahningenieur, Oktober, S. 222.

NÜRNBERGER (W.). — Die **Feinarbeit** im **Gleisoberbau.** (1 300 Wörter.)

1952 **625** .113

Der Eisenbahningenieur, Oktober, S. 224.

SCHAFFER (G.). — Über das Einbinden der Tangenten beim **Winkelbildverfahren.** (1 000 Wörter & Abb.)

E.T.R. Eisenbahntechnische Rundschau. (Köln-Darmstadt.)

1952 **656** .25 (43)

Eisenbahntechnische Rundschau, September-Oktober, S. 289.

DOBMAIER (A.). — **Betriebsentwicklung durch neue Signal- und Fernmeldetechnik.** (6 000 Wörter.)

1952 **656** .257

Eisenbahntechnische Rundschau, September-Oktober, S. 305.

WENZEL (K.E.). — Die **Fertigung neuzeitlicher Signalanlagen.** (4 500 Wörter & Abb.)

1952 **656** .25

Eisenbahntechnische Rundschau, September-Oktober, S. 314 und 325.

SCHMITZ (W.). — **Grundgedanken der neuen Signaltechnik.** (8 000 Wörter & Abb.)

SASSE (H.-W.). — **Höhere Sicherheit durch neuzeitliche Signaltechnik.** (3 000 Wörter.)

1952 **656** .251 (4)

Eisenbahntechnische Rundschau, September-Oktober, S. 329.

WOLF (O.). — **Die europäischen Signalsysteme.** Möglichkeit und Zweckmässigkeit einer **Vereinheitlichung.** (8 000 Wörter, Tafeln & Abb.)

1952 **656** .254

Eisenbahntechnische Rundschau, September-Oktober, S. 339 und 350.

QUARCK (H.). — **Fernmeldetechnik und Eisenbahnbetrieb.** (6 000 Wörter & Abb.)

GRUBER (H.). — Die drahtlose Technik im Eis
bahnfernmeldewesen. (8 000 Wörter & Abb.)

1952 **654** : **656** .254 (4

Eisenbahntechnische Rundschau, September-Oktob
S. 363.

LEITENBERGER (W.). — Post und Eisenbahn **Fernmeldewesen.** (3 000 Wörter & Abb.)

Elektrische Bahnen. (München.)

1952 **621** .33 (4

Elektrische Bahnen, September, S. 198.

MEYER (E.). — 50 Jahre Schweizerische Bund
bahnen. Ein Rückblick über die **Entwicklung des ele
trischen Betriebes der SBB.** (5 000 Wörter & Ab

1952 **621** .3

Elektrische Bahnen, September, S. 205.

TÖFFLINGER (K.). — Zur **Entwicklung des Wec
selstrombahnmotors.** (4 000 Wörter & Abb.)

1952 **621** .3

Elektrische Bahnen, September, S. 210.

MANZ (G.). — Der **Bürsten- und Kommutat
verschleiss bei Wechselstrom-Bahnmotoren.** (10 000 Wö
ter & Abb.)

1952 **621** .3

Elektrische Bahnen, September, S. 222.

MÜLLNER (F.). — **Einphasengeneratoren für Bah
strom.** (4 000 Wörter & Abb.)

1952 **621** .3

Elektrische Bahnen, September, S. 228.

SCHNEIDER (M). — Zusatzumspanner für d
Verbesserung der Fahrleitungsspannung auf Steilrampe
(2 500 Wörter & Abb.)

1952 **621** .335 (4

Elektrische Bahnen, September, S. 232.

KAESS (F.). — **Neue elektrische Triebwagen** der Deu
schen Bundesbahn. (1 500 Wörter & Abb.)

1952 **621** .3

Elektrische Bahnen, September, S. 234.

CLAUSEN (O.). — Graphische Methode zur **Besti
mung der reduzierten Masse eines Stromabnehmer**
(2 000 Wörter & Abb.)

Signal und Draht. (Frankfurt a. Main.)

1952 **656** .2

Signal und Draht, September, S. 144.

SCHMITZ (W.). — Die Entwicklung der **Gleisbil
stellwerkstechnik.** (2 000 Wörter & Abb.)

1952 **656** .254 (7

Signal und Draht, September, S. 153.

OTTER (W.). — **Betriebszugfunk** bei der Nor
Pazifik-Bahn. (1 000 Wörter.)

1952 **656** .25

Signal und Draht, Oktober, S. 163.

SASSE. — **Fernsteuerung von Signalanlagen.** (5 00
Wörter & Abb.)

Verkehr. (Wien.)

52 656 .225 & 656 .261
ehr, Nr. 22, 31 Mai, S. 720.
eue **Container-Entwicklungen.** (600 Wörter & Abb.)

52 656 .214 (436 + 494)
ehr, Nr. 39, 27 September, S. 1289.
EPNIK (B.). — **Germeinschaftsbahnhöfe** Buchs und
Iargrethen. (2 000 Wörter.)

52 385 .63
ehr, Nr. 40, 4. Oktober, S. 1325.
RÜLL (Dr. G.). — Der **neue Text der CIM.** Zur
Revisionskonferenz der Internationalen Eisenbahn-
einkommen vom November 1933 (CIM, CIV).
0 Wörter.)

52 656 .261 (45)
ehr, Nr. 41, 11. Oktober, S. 1357.
arrelli stradali — ein Zauberwort. (1 200 Wörter
bb.)

In English.

The Engineer. (London.)

52 621 .131.1 (42) & 656 .222.1 (42)
Engineer, October 17, p. 506.
JPLIN (W.A.). — **British locomotive performance
ractice.** (5 200 words & figs.)

52 621 .33 (44)
Engineer, October 17, p. 516.
ench Railway electrification. (1 800 words & figs.)

52 656 .254 (42)
Engineer, October 17, p. 529.
uthern Region colour light signalling. (1 800 words
gs.)

Engineering. (London.)

52 691 & 62 (01
neering, August 1, p. 154.
sts of pre-cast prestressed concrete floor beams.
0 words & figs.)

52 621 .33 (492)
neering, August 15, p. 217.
**xed and mobile rectifier substations on the Nether-
s Railways.** (6 200 words & figs.)

52 625 .17
neering, August 15, p. 221.
per-elevation of railway track curves. (1 200 words.)

52 625 .175
neering, August 22, p. 225.
hicle for recording the condition of railway track.
0 words & figs.)

Proceedings, Institution of Civil Engineers. (London.)

1952 62 (01 & 691
Proceedings, Institution of Civil Engineers, Vol. 1, November, p. 709.
RODIN (Stanley). — **Pressure of concrete on formwork.** (37 pages with figs.)

Proceedings, The Institution of Mechanical Engineers. (London.)

1952 625 .215 & 621 .338
Proceedings, The Institution of Mechanical Engineers, Vol. 166, No. 2, p. 217.
GRAFF-BAKER (W.S.). — **Considerations on bogie design,** with particular reference to electric railways. (13 000 words & figs.)

The Locomotive. (London.)

1952 621 .335 (931)
The Locomotive, October, p. 154.
HAUT (J.G.). — **New Zealand Government Rlys. Bo-Bo-Bo electric locomotives.** (1 400 words & figs.)

1952 621 .335 (45)
The Locomotive, October, p. 160.
HAUT (J.G.). — **Electric locomotives in Italy** (3). (400 words & figs.)

1952 621 .33
The Locomotive, October, p. 162.
HAUT (J.G.). — **Further developments in 50-cycle traction.** (1 700 words & figs.)

Modern Transport. (London.)

1952 625 .23 (42)
Modern Transport, August 30, p. 11.
Modern railway carriages. 16. — Electric cars in Lancashire *(to be continued).* (1 200 words & figs.)

1952 621 .132.8 (944)
Modern Transport, September 13, p. 6.
Beyer-Garratt locomotives for Australia. (1 800 words & figs.)

1952 625 .28
Modern Transport, September 27, p. 34.
COCK (C.M.). — **Motive power for railways.** Electrification and Diesel traction. (4 200 words.)

1952 656 .212 (42)
Modern Transport, October 4, p. 13.
Mechanical handling of road freight. (1 200 words & figs.)

1952 656 .254 (42)
Modern Transport, October 11, p. 6.
New power signalbox at Euston. (600 words & figs.)

1952 656 (42)
Modern Transport, October 18, p. 5.
HARRINGTON (J.L.). — **The standard of service in rail transport.** (1 600 words.)

1952 **621** .33 (44) & **656** (44)
Modern Transport, October 18, p. 14; October 25, p. 5.
French transport and industry. (2 200 words & figs.)

The Oil Engine and Gas Turbine. (London.)

1952 **625** .28
The Oil Engine, October, p. 216.
Railway motive power. (1 600 words & fig.)

Railway Age. (New York.)

1952 **625** .17 (73)
Railway Age, September 8, p. 43.
On the Milwaukee... new rail laying practices. (1 400 words & figs.)

1952 **625** .172 (73)
Railway Age, September 15, p. 78.
On the North Western... **cribbing machine proves worth.** (500 words & figs.)

1952 **621** .33
Railway Age, September 15, p. 82.
Railroad electrification... What's the future? (1 200 words & figs.)

1952 **625** .2 (73)
Railway Age, September 22, p. 49.
What about the C. & O. « Train X »? (3 200 words & figs.)

1952 **625** .13 (73)
Railway Age, September 22, p. 54.
How the SP repaired earthquake damage. (3 400 words & figs.)

1952 **625** .14 (73) & **656** .254 (73)
Railway Age, September 29, p. 42.
C.T.C. on Southern frees 48 miles of second track. (1 800 words & figs.)

1952 **621** .131.1 (73)
Railway Age, September 29, p. 51.
A report from the NEW on... **increasing steam locomotive productivity.** (1 900 words & figs.)

1952 **656** .222 (73)
Railway Age, October 6, p. 95.
How goes the Griffin plan? (1 600 words & figs.)

Railway Engineering and Maintenance.

1952 **625** .17 (73)
Railway Engineering and Maintenance, November, p. 1086.
New Haven using **ballast cleaner with new features.** (400 words & figs.)

Railway Gazette. (London.)

1952 **625** .245 (42)
Railway Gazette, August 15, p. 179.
Transformer trolleys for British Railways. (300 words & figs.)

1952 **624** (42)
Railway Gazette, August 22, p. 207.
British Railways through type underline bridge. (2 800 words & figs.)

1952 **621** .131 (
Railway Gazette, August 29, p. 234; September
p. 261.
POULTNEY (E.C.). — **Full *versus* partial thro**
(I-2) *(to be continued)*. (4 500 words, figs. and tabl

1952 **621** .142.4 (
Railway Gazette, August 29, p. 239.
The Laval longitudinal concrete sleeper. (600 wo
& figs.)

1952 **621** .335 (4
Railway Gazette, September 5, p. 268.
50-cycle locomotives for Hungary. (500 words & fig

1952 **621** .131. (
Railway Gazette, September 12, p. 290.
McARD (Geo.W.). — **Locomotive design rati**
(2 400 words & figs.)

1952 **625** .175 (
Railway Gazette, September 12, p. 294.
Manzin track inspection car. (2 100 words & fig

1952 **621** .131 (
Railway Gazette, September 19, p. 317.
Tonnage rating of steam locomotives. (3 000 wo
& figs.)

1952 **624** .63 (4
Railway Gazette, September 19, p. 321.
Reconstruction of Barmouth viaduct, Western Regi
(2 300 words & figs.)

1952 **625** .26 (4
Railway Gazette, September 26, p. 345.
Development of Exmouth Junction wagon shop. (1 4
words & figs.)

Diesel Railway Traction. (London.)

1952 **621** .431.72 (4
Diesel Railway Traction, November, p. 272.
Swiss standard gauge railcar. (2 000 words & fig

1952 **621** .431.72 (4
Diesel Railway Traction, November, p. 277.
German Diesel-hydraulic bogie locomotives. (1 9
words & figs.)

1952 **621** .431.
Diesel Railway Traction, November, p. 281.
The effect of clutch size on vehicle performance. (1 8
words & figs.)

1952 **621** .431.72
Diesel Railway Traction, November, p. 287.
Railcars for Portuguese East Africa.

Railway Mechanical and Electrical Enginee (New York.)

1952 **626.** 431.72 (7
Railway Mechanical and Electrical Engineer, Oct., p.
How to determine what Diesel facilities are neede
(3 600 words & table.)

The English Electric Journal. (Stafford.)

52 **621** .431.72 (944)
English Electric Journal, September, p. 32.
**ain line Diesel-electric locomotives for South Aus-
a.** (4 000 words & figs.)

In Danish (= 439.81).

Sikringsteknikeren. (Copenhagen.)

52 **656** .257 (481) = 439.81
ingsteknikeren, N^{os} 4 and 5, p. 495.
ESSEL HANSEN. — Effects of modern safety
llations on the rationalization of train services and
ting movements. (2 900 words & figs.)

In Spanish.

Boletin de la Asociación permanente Congreso Panamericano de Ferrocarriles. (Buenos-Aires.)

52 **385** .4 (82)
tin de la Asoc. perman. del Congreso Panameric.
de Ferrocarriles, julio-agosto, p. 34.
AGNINO PASTORE (L.N.) & DONALDSON
S.). — **Planificación y racionalización del sistema
viario argentino.** *(Conclusion.)* (6 000 palabras,
dros & mapas.)

Ferrocarriles y Tranvias. (Madrid.)

52 **621** .13 (09
ocarriles y Tranvias, octubre, p. 359.
USTINDUY (M.). — **Evolución de la locomotora
apor** desde el año 1829 hasta el año 1950. (4 000
bras & fig.)

52 **625** .2
ocarriles y Tranvias, octubre, p. 379.
OMAN (C.). — Sobre el **defecto de orientación
mática en los ejes radiantes motores.** (1 500 palabras
ig.)

Revista de Obras Publicas. (Madrid.)

52 **385** (09 (460)
ista de Obras Publicas, Octubre, p. 415.
ENJUMEA BURIN, Conde de GUADALHORCE
. — **Plan de reconstrucción de los Ferrocarriles
ñoles** y su desarrollo. (4 000 palabras.)

In Italian.

Alluminio. (Milano.)

1952 **624** .6 (71) & **669** .71 (71)
Alluminio, n° 5, novembre, p. 505.
Il **ponte di Arvida.** (2 000 parole, tabelle & fig.)

Ingegneria ferroviaria. (Roma.)

1952 **621** .333
Ingegneria ferroviaria, settembre, p. 591.
STAGNI (E.). — Moderni criteri nella costruzione dei **motori monofasi a 50 Hz.** (10 000 parole & fig.)

1952 **625** .143
Ingegneria ferroviaria, settembre, p. 607.
SANDRO DEI POLI. — Contributo allo studio della **inflessione laterale delle rotaie.** (1 500 parole & fig.)

1952 **621** .431.72 (45)
Ingegneria ferroviaria, settembre, p. 611.
MEMMI (V.). — **Automotrici a carrelli da 480 cav.** (4 000 parole & fig.)

1952 **656** .251
Ingegneria ferroviaria, settembre, p. 621.
RIGHI (R.). — Le vigenti norme ferroviarie per i **colori nel segnalamento** ed un recente progetto di **unificazione internazionale.** (4 000 parole & fig.)

1952 **625** .23 (0
Ingegneria ferroviaria, settembre, p. 637.
OMODEI (A.). — **Insonorizzazione** del materiale rotabile. (2 000 parole & fig.)

Rivista di Ingegneria. (Milano.)

1952 **621** .436
Rivista di Ingegneria, settembre, p. 1019.
RUBBO (V.). — Sui **motori Diesel a V.** (1 000 parole & tavola.)

1952 **62** (01
Rivista di Ingegneria, settembre, p. 1039.
BRAY (A.). — **Misure estensimetriche di deformazione dinamiche.** (3 000 parole & fig.)

1952 **621** .336
Rivista di Ingegneria, settembre, p. 1049.
CIPRIANI (A.). — La **flessibilità della linea di contatto.** (1 500 parole & fig.)

In Netherlands.

De Ingenieur. ('s-Gravenhage.)

1952 **624** .2 (492) & **691** (492)
De Ingenieur, n^r 30, 25 Juli, p. Bt. 45.
COEPIJN (W.C.). — **Proefbelasting op spanbetonbalken** van het viaduct Rozelaan te Rotterdam. (3 000 woorden & fig.)

1952 **62** (01 & 69
De Ingenieur, nr 32, 8 Augustus, p. B. 133.
LIGTENBERG (F.K.). — **Experimenteel spanningsonderzoek.** (2 500 woorden & fig.)

1952 **388** (42)
De Ingenieur, nr 33, 15 Augustus, p. V. 41.
ROCKWELL (E.). — The **transport of London's millions,** now and in the future. (5 000 worden & fig.)

1952 **62** (01 & 691
De Ingenieur, nr 37, 12 September, p. Bt. 55.
HAAS (A.M.). — **Experimenteel betononderzoek.** (1 500 woorden.)

1952 **625** .142.4 (43)
De Ingenieur, nr 37, 12 September, p. Bt. 61.
De **nieuwe spanbeton-dwarsligger** van de Duitse spoorwegen. (700 woorden & fig.)

Spoor- en Tramwegen. (Utrecht.)

1952 **621** .33 (492)
Spoor- en Tramwegen, nr 22, 30 October, p. 359; nr 23, 13 November, p. 377.
JORDENS (E.). — De **electrificatie** na de bevrijding. *(Vervolg en slot.)* (2 000 woorden & fig.)

1952 **625** .62 (42)
Spoor- en Tramwegen, nr 22, 30 October, p. 363.
BETLEM (H.P.B.). — **Over het verdwijnen van de tram** in Groot-Brittannië. (2 500 woorden & fig.)

1952 **621** .33
Spoor- en Tramwegen, nr 23, 13 November, p. 371; nr 24, 27 November, p. 390.
KOSTER (J.P.). — **Electrisch remmen bij gelijkstroomtractie.** (3 500 woorden & fig.)

1952 **625** .23 (73)
Spoor- en Tramwegen, nr 23, 13 November, p. 381.
VAN OMME (N.). — **Roestvrij-stalenrijtuigbouw** Patent Budd. (700 woorden & fig.)

In Portuguese.

Boletin da C.P. (Lisboa.)

1952 **624** .62 (469)
Boletin da C.P., nº 281, novembro, p. 1-27.
ABRAGÃO (F.). — **A ligação de Lisboa com o Porto** por Caminho de Ferro.
A **ponte Maria Pia** sobre o Rio Douro.
A inauguração da **Ponte « Maria Pia ».** (Prefácio por R. de Espregueira Mendes, Director General da C.P.). (27 paginas, figuras & gravura fora texto.)

In Swedish (= 439.71).

Meddelanden från Svenska Lokaltrafikföreningen. (Stockholm.)

1952 **625** .13 (485) = 43
Meddelanden från Svenska Lokaltrafikföreningen, n
p. 5.
ENELL (G.). — Traffic problems at Gothemb **Subway** under the « Gotaelven » river. (1 500 wo & figs.)

1952 **625** .42 (485) = 439.71
Meddelanden från Svenska Lokaltrafikföreningen, n
p. 10.
HILLBOM (B.). — **Stockholm underground railw** Slussen-Kungsgatan central line. (1 600 words & f

1952 **621** .332 : **625** .42 (485) = 43
Meddelanden från Svenska Lokaltrafikföreningen, n
ANCKER (O.). — **Constructions in connection** **the supply of electric current** for electric traction on Stockholm underground railway. (3 300 words & fi

Nosdisk Järnbanetidskrift. (Stockholm).

1952 **614** .8 : **624** (489) = 439
Nordisk Järnbanetidskrift, No. 3, p. 91.
JEPPESEN (A.). — **Repair of the Little Belt bri- and its fire protection** after the damages caused by in 1946. (2 400 words & figs.)

1952 **625** .42 (485) = 439
Nordisk Järnbanetidskrift, No. 4, p. 131.
EWERT (C.). — The new **Stockholm undergro railway** — modern service. (1 300 words & figs.)

1952 **656** .254 (485) = 439
Nordisk Järnbanetidskrift, No. 7, p. 248.
LINDEROTH (M.). — **Automatic telephone syst** on the Swedish Railways. (3 800 words & figs.)

1952 **656** .211.7 (489) = 439
Nordisk Järnbanetidskrift, No. 8, p. 307.
TERKELSEN (E.). — A **new Danish ferry-boat** the Great Belt crossing. (800 words & figs.)

Spårväg och Buss. (Stockholm).

1952 **656** .257 (485) = 439
Spårväg och Buss, No. 5, p. 67.
BOBERG (I.). — A **modern interlocking constructi** (4 700 words & figs.)

M. Weissenbruch & Co., Ltd., Printer to the King, 49, rue du Poinçon, Bruxelles.

MONTHLY BIBLIOGRAPHY OF RAILWAYS (1)

PUBLISHED UNDER THE SUPERVISION OF

P. GHILAIN,

General Secretary of the Permanent Commission of the International Railway Congress Association.

(MARCH 1953)

6. 385. (02]

I. — BOOKS.

In French.

52 **693**
UMA (H.).
ants hydrauliques. Propriétés, choix et conditions
ploi. Préface de E. Freyssinet. 2e édition.
ris (VIe), Dunod, éditeur, 92, rue Bonaparte. Un
me (14 × 22 cm) de XII-128 pages, avec 19 figures.
: broché, 760 fr. fr.)

52 **621** .43
IASSON (G.) & TOURANCHEAU (A.L.).
éments de construction à l'usage de l'ingénieur.
e X : *Moteurs à combustion interne.*
ris (VIe), Dunod, éditeur, 92, rue Bonaparte. Un
me (16 × 25 cm) de VI-154 pages, avec 183 figures.
: broché, 360 fr. fr.)

52 **62** (01
NDIN (Ch.).
de-Mémoire Dunod « Résistance des matériaux,
ériaux de construction ».
ris, Dunod, éditeur. Un volume broché (10 × 15 cm)
07 pages, avec 241 figures. (Prix : 450 fr. fr.)

52 **691**
OS (A.).
imie physique et résistance des ciments.
ris, Technique et Documentation, éditeur, 11, rue
isier. Une brochure (16 × 24 cm) de 60 pages,
36 figures. (Prix : 780 fr. fr.)

52 **313** .385
ON INTERNATIONALE DES CHEMINS DE
FER (U.I.C.).
atistique internationale des Chemins de fer. Année
.
ris (XVIIe), publiée par le Secrétariat Général de
.C., 10, rue de Prony. Une brochure (24 × 31 cm)
56 pages, avec de très nombreux tableaux relatifs
consistance et aux moyens des réseaux, aux résul-
techniques de l'exploitation, aux résultats financiers
des questions diverses.

In German.

1952 **625** . 14 (02
HANKER (R.).
Eisenbahnoberbau. Die Grundlagen des Gleisbaues.
Wien I, Springer-Verlag. VIII-256 Seiten, mit 258 Textabbildungen. (Preis : Ganzleinen, DM. 43.20.)

1952 **625** .28
NORDMANN (Prof. Dr.-Ing. E.h.H.).
Die Mechanik der Zugförderung und ihre wissenschaftlich-experimentellen Grundlagen.
Berlin, Göttingen, Heidelberg, Springer-Verlag. — Ein Band V-170 Seiten, mit 50 Abbildungen. (Preis : steif geheftet, DM. 19.80.)

1952 **694** (02
von HALASZ (R.).
Holzbau-Taschenbuch. 4. Auflage.
Berlin, Verlag von Wilhelm Ernst & Sohn. — Ein Band (12 × 17 cm), mit VII-427 Seiten und 510 Abbildungen. (Preis : broschiert, DM. 19.50; gebunden, DM. 21.50).

In English.

1952 **621** .13 (05 (42)
ALLEN (C.J.).
Trains Annual, 1953.
London : Ian Allan Limited, Craven House. — One volume (9 3/4 × 7 1/4 in.) of 96 pages. Illustrated. (Price : 9 s. 6 d. net.)

1952 **385** (061.4 (73)
American Railway Engineering Association — Bulletin No. 504 — Vol. 54.
Chicago 5, Ill. : Published by The American Railway Engineering Association, 59, East Van Buren Street. — One brochure of 205 pages illustrated. Number for November 1952. (Subscription : 10 $ per annum.)

---

(1) The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress
ntly with the Office Bibliographique International, of Brussels. (See « Bibliographical Decimal Classification as applied to Railway
e », by L. WEISSENBRUCH, in the number for November 1897, of the *Bulletin of the International Railway Congress* p 1509.)

1952 621 .132.1 (73)

BRUCE (A.W.).

The steam locomotive in America. Its development in the Twentieth Century.

New York : W.W. Norton & Co., publishers. — One volume (6 1/2 × 9 1/2 in.) of 443 pages, illustrated. Cloth bound. (Price : $ 7.50.)

1952 621 .33

CARR (T.H.).

Sub-station-practice.

London : Chapman & Hall Ltd., publishers, 37, Essex Street, W.C. 2. — One volume (5 1/2 × 8 1/2 in.) of 467 pages with 362 illustrations. (Price : 55 s. net.)

1952 693

CHAMPION (F.A.).

Corrosion testing procedure.

New York, N.Y. : John Wiley & Sons, Inc. — One volume (5 3/4 × 8 3/4 in.) of 369 pages, tables, charts, diagrams. Bound. (Price : $ 6.25.)

1952 385 (09 (42)

Facts and figures about British Railways.

One booklet of 32 pages (4 × 6 1/2 in.). Published and obtainable at The Railway Executive, room, 323, Marylebone road, 222, London N.W. 1.

1952 669

HUME-ROTHERY (W.), CHRISTIAN (J.W.) and PEARSON (W.B.).

Metallurgical Equilibrium Diagrams.

London : The Institute of Physics, 47, Belgrave Square, S.W. 1. — One volume (6 × 9 1/2 in.) of 311 pages, with 239 illustrations. (Price : 50 s. net.)

1952 621 .431.72 (7

RECK (Franklin M.).

On Time. — The history of Electro-Motive Divisio
of General Motors Corporation.

One volume (5 1/4 × 7 7/8 in.) of 184 pages, publishe
by the Electro-Motive Division of General Moto
Corporation.

1952 621 .132

REED (Brian).

Modern locomotives.

London : Temple Press Ltd., Bowling Green Lan
E.C. 1.

One volume (10 × 7 1/2 in.) of 87 pages. Illustrate
(Price : 9 s. 6 d.)

1952 621 .132.1 (4

WRIGHT (J.S.B.).

« King George V ».

Glasgow : Collins, 144, Catherine Street, C. 4.

One brochure (6 3/4 × 10 in.) of 22 pages. Illustra
tions in colour and line. (Price : 6 s. net.)

1952 6

YOST (Edna).

Modern American Engineers.

Philadelphia, Pa. : J.B. Lippincott Company. — On
volume (5 1/4 × 8 in.) of IX and 182 pages. Clot
(Price : $ 2.50.)

In Spanish.

1952 62

CASADO (C. Fernández).

Cálculo de estructuras reticulares. Sexta edición.

Madrid, Editorial Dossat, S.A., Plaza de Sant
Ana, 9 — Apart. 47. 508 paginas, 300 figs., 103 láms
4 tabl. (Precio : 160 pesetas.)

[**016.** 385. (05]

II. — PERIODICALS.

In French.

Annales des Travaux Publics de Belgique.
(Bruxelles.)

1952 62 (01

Annales des Travaux publics de Belgique, août, p. 519.

PROT (M.). — **La thèse probabiliste de la sécurité.** (4 500 mots & fig.)

Bulletin scientifique
de l'Association des Ingénieurs électriciens
sortis de l'Institut Électrotechnique Montefiore.
(Liège.)

1952 621 .31

Bulletin scient. de l'Assoc. des Ing. électric. sortis de l'Institut Electrotech. Montefiore, juillet-août, p. 591 et suivantes.

Services auxiliaires dans les centrales électriques. Rapports présentés aux Journées d'Etudes Internationale
(mai 1952), à l'occasion du 65e anniversaire de l'A.I.M.
avec Discussion. (140 pages, tableaux & fig.)

1952 621 .3

Bulletin scient. de l'Assoc. des Ing. électric. sortis d
l'Institut Electrotech. Montefiore, juillet-août, p. 73
et suivantes.

**Conception des postes de commande et de contrô
des centrales thermiques.** Rapports présentés aux Jou
nées d'Etudes Internationales (mai 1952) à l'occasio
du 65e anniversaire de l'A.I.M., avec Discussion. (12
pages, tableaux & fig.)

Bulletin technique de la Suisse Romande.
(Lausanne.)

1952 656 .2

Bulletin technique de la Suisse Romande, 4 octobr
p. 257.

DUTOIT (R.). — **Sécurité et signalisation.** (7 00
mots & fig.)

1952 **62** (01
ulletin technique de la Suisse Romande, 18 octobre, p. 273.
KLITCHIEFF (J.M.). — Quelques applications de éries à des **problèmes de stabilité élastique.** (1 500 mots fig.)

1952 **621** .335 (494)
ulletin technique de la Suisse Romande, 15 novembre, p. 307.
Nouvelle locomotive lourde pour les trains directs de ligne du Saint-Gothard. (1 500 mots & fig.)

1952 **62** (01 & **691**
ulletin technique de la Suisse Romande, 13 décembre, p. 325.
IcKELVEY (K.K.). — **Le calcul de l'armature éconoique des éléments prismatiques** de section rectanulaire au moyen d'abaques. (3 000 mots, tableaux fig.)

1952 **624** .63 (43)
ulletin technique de la Suisse Romande, 13 décembre, p. 334.
Le premier **pont en béton précontraint** sur le Rhin. 800 mots & fig.)

Electricité. (Paris.)

1952 **621** .32
lectricité, septembre, p. 175.
HENRI-MARTIN (B.). — **L'éclairage industriel.** 4 000 mots & fig.)

1952 **656** .25 : **621** .33
lectricité, octobre, p. 193.
WALTER (J.). — **Problèmes de signalisation ferroiaire sur les lignes électrifiées à courant industriel.** 4 000 mots & fig.)

Génie Civil. (Paris.)

1952 **385** (09 (8)
énie civil, nº 3336, 1er novembre, p. 411.
Le chemin de fer « Central Pérou ». (1 000 mots & fig.)

1952 **721**
énie civil, nº 3337, 15 novembre, p. 429.
KATEL (I.E.). — **Les conditions d'emploi des matériaux absorbants dans l'acoustique architecturale.** (1 500 mots & fig.)

1952 **624** (494)
Génie civil, nº 3337, 15 novembre, p. 434.
Le déplacement du pont de la gare sur l'Aar, à Olten (Suisse). (600 mots & fig.)

L'Industrie des Voies ferrées et des Transports automobiles. (Paris.)

1952 **621** .7 & **625** .25
L'Industrie des Voies ferrées et des Transp. automobiles, septembre, p. 109.
PETIT-JEAN. — **L'application aux garnitures de freins et d'embrayages des procédés de collage des alliages légers.** (2 000 mots & fig.)

1952 **621** .132.8 (44) & **621** .438 (44)
L'Industrie des Voies ferrées et des Transp. automobiles, octobre, p. 120.
PICARD. — La **locomotive Renault à turbine** avec générateur à pistons libres. (1 500 mots & fig.)

1952 **621** .431.72 (66)
L'Industrie des Voies ferrées et des Transp. automobiles, décembre, p. 164.
MÉDALIA. — Les **locomotives Diesel-mécaniques** de la Régie des Chemins de fer du Cameroun. (3 000 mots & fig.)

L'Ossature métallique. (Bruxelles.)

1952 **625** .1 (493)
L'Ossature métallique, novembre, p. 513.
BALBACHEVSKY (G.N.). — La **Jonction Nord-Midi** à Bruxelles. (2 000 mots & fig.)

1952 **698**
L'Ossature métallique, novembre, p. 543.
FONTEYN (M.). — La **peinture des constructions métalliques et ouvrages d'art.** (3 500 mots.)

1952 **624** .2 (493)
L'Ossature métallique, novembre, p. 553.
DEGREEF (V.) & SOETE (A.). — Résultats de quelques **mesures de tension sur le pont-rails** de Nimy-Maisières. (2 000 mots, tableaux & fig.)

Rail et Route. (Paris.)

1952 **621** .33 (44)
Rail et Route, septembre, p. 7; octobre, p. 3.
Electrification de Paris-Lyon. (4 500 mots & fig.)

1952 **656** .225 & **656** .261
Rail et Route, septembre, p. 16; octobre, p. 11; novembre, p. 3.
Les **divers modes de transport mixte rail-route.** (9 000 mots & fig.)

1952 **625** .23 (09
Rail et Route, novembre, p. 18.
LEJEUNE & OMS. — **L'évolution de la voiture à voyageurs** depuis le début du siècle dernier jusqu'à nos jours. (1 500 mots & fig.)

1952 **621** .33 & **625** .13
Rail et Route, décembre, p. 21.
La **traction électrique dans les grands tunnels routiers.** (1 300 mots & fig.)

Revue Générale des Chemins de fer. (Paris.)

1952 **625** .143.5
Revue générale des Chemins de fer, novembre, p. 469.
LÉVI (R.). — La **fixation des rails aux traverses.** Cinq ans d'expérience des attaches doublement élastiques. (3 000 mots & fig.)

1952 **625** .213
Revue générale des Chemins de fer, novembre, p. 476.
CHARTET. — La **suspension verticale des véhicules ferroviaires.** Etude théorique. (10 000 mots, tableaux & fig.)

1952 **625** .13 (44)
Revue générale des Chemins de fer, novembre, p. 497.
RIFFARD. — **Remise en état du revêtement du souterrain** du Fréjus. (1 000 mots & fig.)

1952 **625** .173 (44)
Revue générale des Chemins de fer, novembre, p. 501.
MICHON & FARBOS. — Le **renouvellement de la voie** par chantiers à grand rendement avec outillage spécialisé S.N.C.F. (type Sud-Ouest). (2 000 mots & fig.).

1952 **656** .215 (45)
Revue générale des Chemins de fer, novembre, p. 509.
L'**éclairage fluorescent** de la Gare centrale de Milan. (800 mots & fig.)

La Vie du Rail. (Paris.)

1952 **385** (09 (66)
La Vie du Rail, 10 novembre, p. 3.
BLANCHER (G.) & DESVOYES (G.). — **Visage ferroviaire du Cameroun.** (3 000 mots & fig.)

1952 **656** .212.5 (44)
La Vie du Rail, 8 décembre, p. 3.
Le **triage** de Gevrey. (800 mots & fig.)

In German.

Der Eisenbahningenieur. (Frankfurt a. Main.)

1952 **621** .331 (43)
Der Eisenbahningenieur, November, S. 232.
BIRKHOFER (A.). — Das **Eisenbahn-Kraftwerk** Penzberg. (3 000 Wörter & Abb.)

1952 **625** .26 (43)
Der Eisenbahningenieur, November, S. 237.
HANSEN (K.). — **Wirtschaftliche Unterhaltung der Güterwagen** der Deutschen Bundesbahn. (2 000 Wörter & Abb.)

1952 **385** .587 (43)
Der Eisenbahningenieur, November, S. 242.
TEICH (A.). — **Erfassung von Betriebsvorgängen** mit der Betriebsschauuhr. (500 Wörter & Abb.)

1952 **625** .151
Der Eisenbahningenieur, November, S. 244.
HÖFER (M.). — **Bogenweichen** in kubischen Parabeln. (1 500 Wörter & Abb.)

Elektrische Bahnen. (München.)

1952 **621** .
Elektrische Bahnen, Oktober, S. 245.
ABLASSMAYER (H.). — **Die Hochfrequenz i elektrischen Zugbetrieb.** II. und III. Teil. (8 000 Wört & Abb.)

1952 **621** .
Elektrische Bahnen, Oktober, S. 254.
TIPPL (J.). — **Rundfunkstörungen durch elektrisc Fahrzeuge.** (Mitteilung aus der Elektrischen Versuch anstalt der Österreichischen Bundesbahnen.) (5 00 Wörter & Abb.)

1952 **621** .3
Elektrische Bahnen, Oktober, S. 260.
HUMBURG (K.) & KAIZIK (M.). — **Feldschwächun durch Kurzschlussströme bei Einphasen-Reihenschlus Motoren.** (1 500 Wörter & Abb.)

1952 **621** .33
Elektrische Bahnen, Oktober, S. 263.
MANZ (G.). — Der Bürsten- und Kommutato verschleiss bei **Wechselstrom-Bahnmotoren.** (600 Wört & Abb.)

E.T.R. Eisenbahntechnische Rundschau. (Köln-Darmstadt.)

1952 **656** .2 (43
Eisenbahntechnische Rundschau, November, S. 369.
LEIBBRAND (K.). — **Betriebsuntersuchungen grosse Verkehrsknotenpunkte.** Erläutert am Beispiel Haupt bahnhof Nürnberg. (4 000 Wörter & Abb.)

1952 **625** .21
Eisenbahntechnische Rundschau, November, S. 38
KREISSIG (E.). — Der **exzentrische Pufferstoss** (2 000 Wörter & Abb.)

1952 **656** .234 (43
Eisenbahntechnische Rundschau, November, S. 385
EFFMERT (W.). — Der **Berufsverkehr,** eine sozial Aufgabe für die Eisenbahnen. (2 500 Wörter & Abb.

1952 **625** .12
Eisenbahntechnische Rundschau, November, S. 391
KÜHN (G.). — Die **Verwendung von Flachbagger geräten im Eisenbahnbau.** (2 000 Wörter & Abb.)

1952 **621** .133.
Eisenbahntechnische Rundschau, November, S. 397
KRUGMANN (H.L.). — Speiseverbot bei **Wasser mangel im Lokomotivkessel,** ja oder nein? (2 500 Wörter.)

Glasers Annalen. (Berlin.)

1952 **625** .286 (43)
Glasers Annalen, Oktober, S. 219.
TASCHINGER. — **Schienenomnibusse mit 6 m festem Achsstand.** (8 000 Wörter & Abb.)

1952 **621** .335
lasers Annalen, Oktober, S. 232.
FRITSCHE (R.H.). — Zur Frage der **Unterhaltungs-**
sten elektrischer Lokomotiven für 16 2/3 oder 50 Hertz.
800 Wörter.)

hweizerisches Archiv für Verkehrswissenschaft und Verkehrspolitik. (Zürich.)

1952 **656** (436)
hweizerisches Archiv für Verkehrswissenschaft und
Verkehrspolitik, Nr. 4, S. 289.
WALDBRUNNER (K.). — Neue **Verkehrsgesetze**
id Verkehrsteilung Schiene-Strasse in Österreich.
500 Wörter & Tabellen.)

1952 **385** (06.15
hweizerisches Archiv für Verkehrswissenschaft und
Verkehrspolitik, Nr. 4, S. 296.
DREYER (G.). — **L'Union internationale des Chemins**
fer. Son rôle, son activité, son avenir. (5 000 mots
tableaux.)

1952 **347** .763.4 (43)
hweizerisches Archiv für Verkehrswissenschaft und
Verkehrspolitik, Nr. 4, S. 313.
BUSCH (F.). — Die **Deutsche Bundesbahn in ihrem**
rhältnis zum Staat nach dem neuen Bundesbahngesetz.
500 Wörter.)

1952 **656** (43)
hweizerisches Archiv für Verkehrswissenschaft und
Verkehrspolitik, Nr. 4, S. 319.
CONRAD (O.). — Aus der deutschen Verkehrs-
rtschaft. **Verkehrspolitik durch Aufgabenteilung.** (1 500
örter.)

Signal und Draht. (Frankfurt a. Main.)

1952 **656** .257 (43)
gnal und Draht, November, S. 173.
KLEINBAUER (K.). — **Fernsteuerung der Signal-**
lagen auf der Strecke Regensburg-Nürnberg. (10 000
örter & Abb.)

1952 **656** .254 (489)
gnal und Draht, November, S. 188.
HANSEN (W.). — Die **selbsttätige Schranken-**
lage bei Buddinge (Dänemark). (1 000 Wörter & Abb.)

In English.

Bulletin — American Railway Engineering Association. (Chicago.)

1952 **691**
lletin, American Railway Engineering Association,
Vol. 54, No. 503, September-October, p. 191.
BLACKBURN (J.B.). — **Tests on waterproofing**
atings for concrete surfaces. (52 pages, illustrated.)

1952 **62** (01 & **624** .63 (0
Bulletin, American Railway Engineering Association, Vol. 54, No. 503, September-October, p. 243.
Description and analysis of impact **tests made on reinforced concrete bridges** under Diesel and steam locomotives. (172 pages, illustrated.)

1952 **385** .3 (73)
Bulletin, American Railway Engineering Association, Vol. 54, No. 503, September-October, p. 413.
MOORE (B.H.). — **The Federal valuation of the railroads in the United States.** (87 pages.)

The Engineer. (London.)

1952 **621** .132.1 (944)
The Engineer, October 31, p. 572.
Articulated locomotives for New South Wales. (6 000 words & figs.)

1952 **621** .132.1 (6)
The Engineer, November 7, p. 628.
Locomotives for the Sudan Railways. (400 words & fig.)

1952 **656** .222.1
The Engineer, November 14, p. 638; November 21, p. 674; November 28, p. 710; December 5, p. 746; December 12, p. 782; December 19, p. 818.
LIVESAY (E.H.). — **Trans-Canadian and British Railways experiences.** (22 000 words & figs.)

1952 **621** .438
The Engineer, November 14, p. 643.
A coal-burning gas turbine. (2 800 words & figs.)

1952 **625** .143 & **625** .212
The Engineer, November 21, p. 688.
Conference on rubber in railway engineering. (700 words & fig).

1952 **621** .431.72 (54)
The Engineer, November 28, p. 721.
Diesel-electric locomotives for Ceylon. (1 400 words & figs.)

1952 **656** .254 (42)
The Engineer, November 28, p. 723.
Push button signalling control at Ealing Broadway. (900 words & figs.)

1952 **656**
The Engineer, November 28, p. 737.
MENZLER (F.A.A.). — **Statistical methods and operational research in transport.** (4 000 words & tables.)

Engineering. (London.)

1952 **691**
Engineering, Augustus 29, p. 276.
COWAN (H.). — **Inelastic deformation of reinforced concrete** in relation to ultimate strength. (3 200 words & figs.)

1952 **691**
Engineering, September 5, p. 313; September 12, p. 354.
STEWART (D.A.). — **Some recent developments in concrete technology.** (4 600 words & figs.)

1952 **625** .28
Engineering, September 26, p. 421; October 3, p. 453.
COCK (C.M.). — **Motive power for railways.** (6 000 words.)

1952 **656** .254 (42)
Engineering, October 17, p. 513.
New signalling installation at Euston Station, London. (2 300 words & fig.)

1952 **621** .132.1 (54)
Engineering, October 31, p. 575.
Passenger locomotive for Indian metre-gauge railways. (300 words & figs.)

1952 **621** .33 (44)
Engineering, November 21, p. 654.
Electrification of the Paris-Lyons railway. (3 900 words & figs.)

1952 **656** .226 (42)
Engineering, November 28, p. 690.
Electric tractor for railway service. (300 words & fig.)

1952 **621** .335 (54)
Engineering, November 28, p. 700.
1 000 HP Diesel-electric locomotives for Ceylon Government Railway. (1 200 words & figs.)

The Locomotive. (London.)

1952 **621** .132.1 (54)
The Locomotive, November, p. 169.
Indian metre-gauge Pacifics. (500 words & fig.)

1952 **621** .132.8 (5) & **621** .133.1 (5)
The Locomotive, November, p. 170.
2-8-2 Oil-fired locomotive. — Hedjaz Railways. (600 words & figs.)

1952 **625** .24 (42)
The locomotive, November, p. 171.
Freight handling B.R. (300 words & figs.)

Modern Transport. (London.)

1952 **385** (09 (492)
Modern Transport, November 1, p. 3.
DEN HOLLANDER (F.Q.). — **Transport system of the Netherlands.** (2 000 words.)

1952 **625** .4 (485)
Modern Transport, November 8, p. 3; November 13, p. 13.
Progress of Stockholm underground. (1 800 words & figs.)

1952 **385** (41
Modern Transport, November 8, p. 7
PEARSON (A.J.). — **Large-scale railway manag ment.** (900 words.)

1952 **656** .251 (4
Modern Transport, November 8, p. 11.
Colour-light signalling. Southern Region complet another stage. (800 words & figs.)

The Oil Engine. (London.)

1952 **621** .431.72 (
The Oil Engine, December, p. 274.
Ceylon's 25 new locomotives. (3 000 words & figs

1952 **621** .431.72 (4
The Oil Engine, December, p. 277.
British Railways railcar programme. (2 400 wor & figs.)

1952 **621** .438 (7
The Oil Engine, December, p. 303.
Gas-turbine locomotives on the Union Pacific. (30 words & fig.)

Railway Age. (New York.)

1952 **625** .2 (73) & **698** (7
Railway Age, October 6, p. 106.
Hot-spray finish applied under varied conditions. (60 words & figs.)

1952 **385** (09 (7
Railway Age, October 13, p. 97.
Rock Island marks its 100th anniversary. (63 pag illustrated.)

1952 **656** .254 (7
Railway Age, October 20, p. 41.
On the Atlantic Coast Line... **Lots of use for talk-bac loudspeakers.** (2 000 words & figs.)

1952 **625** .172 (7
Railway Age, October 27, p. 48.
How Frisco organizes for **track maintenance withou section gangs.** (2 400 words & figs.)

1952 **656** .212 (7
Railway Age, October 27, p. 52.
This single yard control machine does everything (2 200 words & figs.)

Railway Gazette. (London.)

1952 **621** .338 (494
Railway Gazette, October 3, p. 378.
Dual-voltage stock in Switzerland. (300 words & figs

1952 **656** .24 (42
Railway Gazette, October 10, p. 403; October 31, p. 49
Claims prevention : A universal problem. (2 200 word & figs.)

952 **621** .131.3 (42)
lway Gazette, October 10, p. 407; October 17, p. 430; October 24, p. 460.
OULTNEY (E.C.). — **British Railways locomotive s** (1-2-3). (6 800 words & figs.)

952 **656** .254 (42)
lway Gazette, October 17, p. 434.
outhern Region colour-light signalling. (1 300 words figs.)

952 **656** .28 (42)
lway Gazette, October 31, p. 480.
olonel Wilson's annual report. (1 800 words & tables.)

952 **625** .251
lway Gazette, October 31, p. 488; November 7, p. 514; November 14, p. 547; November 21, p. 570; December 5, p. 627.
ROADBENT (H.R.). — **Confines of braking.** (5 000 ds & figs.)

952 **621** .335 (492)
lway Gazette, October 31, p. 492.
ew power-bogie locomotives in Holland. (500 words ig.)

952 **656** .226 (42)
lway Gazette, October 31, p. 497.
lectric horses for C. & D. services. (400 words & figs.)

952 **625** .255 (42)
lway Gazette, November 7, p. 515.
ritish Railways, new vacuum brake cylinder. (300 ds & figs.)

952 **621** .132.1 (54)
lway Gazette, November 7, p. 517.
A'COSTA (R.G.). — **Metre-gauge locomotives for ia.** (2 300 words & figs.)

952 **621** .132.1 (54)
lway Gazette, November 14, p. 550.
YP » locomotives for India. (400 words & figs.)

952 **656** .254 (42)
lway Gazette, November 28, p. 599.
ELL (R.). — **Control desk signalling operation** at ing Broadway. (1 800 words & figs.)

952 **625** .162 (42)
lway Gazette, November 28, p. 603.
xperimental lifting barriers on North Eastern Region. words & fig.)

952 **621** .335 (494)
lway Gazette, November 28, p. 604.
ew locomotives for Gotthard line. I. *(To be continued.)* 00 words & figs.)

Diesel Railway Traction. (London.)

952 **621** .431.72 (492)
sel Railway Traction, December, p. 295.
iesel Traction in Holland. (3 600 words & figs.)

1952 **621** .335
Diesel Railway Traction, December, p. 303.
BOWLER (J.E.). — **Series-parallel control.** II. (3 200 words & figs.)

1952 **621** .431.72 (485)
Diesel Railway Traction, December, p. 311.
Diesel-hydraulic shunters for Sweden. (700 words & figs.)

The Railway Magazine. (London.)

1952 **656** .254 (42)
The Railway Magazine, December, p. 829.
Brighton line resignalling, Southern Region. (1 200 words & figs.)

In Spanish.

Hormigón elastico. (Buenos Aires.)

1952 **691** (4)
Hormigón elastico, nº 9, septiembre, p. 4; nº 10, octubre, p. 39.
PIZZETTI (J.). — **La evolución de la precompresión** en Europa. (3 000 palabras & fig.)

1952 **691**
Hormigón elastico, nº 9, septiembre, p. 18.
L'HERMITE (R.). — **El control de la calidad del hormigón.** (5 000 palabras & fig.)

1952 **624** .2 & **691**
Hormigón elastico, nº 10, octubre, p. 28.
SCIAMMARELLA (C.). — Estudio experimental de **vigas tipo « Zofra ».** (2 500 palabras & fig.)

Revista de Obras Publicas. (Madrid.)

1952 **385** (09 (460)
Revista de Obras publicas, diciembre, p. 539.
Situación actual del Plan general de Reconstrucción de la R.E.N.F.E. (6 000 palabras & mapa.)

In Italian.

Ingegneria ferroviaria. (Roma.)

1952 **625** .143 (0
Ingegneria ferroviaria, ottobre, p. 683.
STABILINI (L.). — Contributo allo studio dell' **inflessione laterale delle rotaie.** L'effectto della non uniforme resistenza alla traslazione longitudinale del binario. (1 500 parole & fig.)

1952 **62** (01 & **691**
Ingegneria ferroviaria, ottobre, p. 687.
ZANABONI (O.). — Sulla verifica di **stabilità delle sezioni di cemento armato soggetti a flessione composta.** (2 000 parole & fig.)

1952 **656** .235 (45)
Ingegneria ferroviaria, ottobre, p. 698.
SANTORO (F.). — Sulle nuove basi di **tariffe differenziali merci.** (1 500 parole.)

1952 **385** .57
Ingegneria ferroviaria, ottobre, p. 701.
FANELLI (M.). — Nuovo apparecchio per la misura e la registrazione dei **tempi di reazione.** (3 500 parole & fig.)

1952 **621** .431.72 & **656** .27
Ingegneria ferroviaria, ottobre, p. 712.
BRACHET-SARGENT (L.). — Recenti **sviluppi dell' automotrice leggera per linee secondarie.** (3 000 parole, 1 tabella & fig.)

1952 **656** (45)
Ingegneria ferroviaria, ottobre, p. 725.
TARQUINI (G.). — **I trasporti merci ferroviari-aerei** in Italia. (1 500 parole & fig.)

Politica dei Trasporti. (Roma.)

1952 **388** (73)
Politica dei Trasporti, ottobre, p. 407.
GENTILI (A.). — Impressioni sulla situazione dei **trasporti pubblici urbani** negli Stati Uniti d'America. (3 000 parole & fig.)

1952 **656**
Politica dei Trasporti, ottobre, p. 416.
TREVISANI (R.). — Premesse per un **coordinamento tra i trasporti aerei e terrestri.** (3 000 parole & fig.)

Rivista di Ingegneria. (Milano.)

1952 **624**
Rivista di Ingegneria, novembre, p. 1265.
DEMAESTRI (A.). — **Generalizzazione del metodo di Gehler : strutture con travi di fondazione.** (2 000 parole & fig.)

In Netherlands.

De Ingenieur. ('s-Gravenhage.)

1951 **621** .333 (492)
De Ingenieur, 12 Januari, p. E. 1.
KOSTER (J.P.). — De **tractiemotoren** voor de nieuwe electrische locomotieven der N.V. Nederlandsche Spoorwegen. (3 000 woorden & fig.)

1951 **385** (09 (47 + 5
De Ingenieur, 23 Maart, p. V. 11.
SUBBOTIN (S.). — Enkele cijfers over **Russisc spoorwegen.** (4 000 woorden & kaart.)

1951 **624**
De Ingenieur, 6 April, p. Bt. 25.
NOZ (F.J.). — Bijdrage tot de **berekening van relaxatie-grootheden van Cross,** voor rechte staven m veranderlijk traagheidsmoment. (3 000 woorden, tabell & fig.)

1951 **621** .143
De Ingenieur, 18 Mei, p. V. 19.
MUNDT (Th.W.). — Een **nieuwe spoorstaafopleggi** en de ontwikkeling daarvan. (4 000 woorden & fig.)

1951 **621** .33
De Ingenieur, 18 Mei, p. V. 25.
DOUWES DEKKER (C.E.). — **Wielslip bij loc motieven en motortreinen** en de middelen om dit bij electrische aandrijving tegen te gaan. (2 000 woord & fig.)

1952 **385** (09 (49
De Ingenieur, nr 48, 28 November, p. A. 529.
DEN HOLLANDER (F.Q.). — Enige beschouwinge over de **modernisering van de Nederlandsche Spoorwege** (7 000 woorden.)

Spoor- en Tramwegen. (Utrecht.)

1952 **656** .212
Spoor- en Tramwegen, nr 24, 27 November, p. 38
nr 25, 11 December, p. 407; nr 26, 25 Decembe
p. 424.
VAN LOON (O.C.A.) & FLIPSE (J.L.). — H **moderne rangeeremplacement.** (7 000 woorden & fig

---

1952 **385** (09 (49
Spoor- en Tramwegen, nr 26, 25 December, p. 41
Enige beschouwingen over de **modernisering van d Nederlandsche Spoorwegen.** (Rede van Jr. F.Q. de Hollander.) (5 000 woorden & fig.)

In Portuguese.

Gazeta dos Caminhos de ferro. (Lisboa.)

1952 **621** .392 & **625** .144.
Gazeta dos Caminhos de ferro, nº 1555, 1 de outubr
p. 283.
GALRINHO PERNES (O.). — Problemas da vi férrea. **Carris continuos.** (1 000 palavras & fig.)

1952 **656** .22
Gazeta dos Caminhos de ferro, nº 1560, 16 de dezembr
p. 371.
FARIA LAPA (J.). — O caracter acessório d necessidade « transporte » e **as condicôes e os método de exploracâo dos serviços de transportes.** (1 500 palavras.

M. Weissenbruch & Co., Ltd., Printer to the King, 49, rue du Poinçon, Bruxelles.

MONTHLY BIBLIOGRAPHY OF RAILWAYS(1)

PUBLISHED UNDER THE SUPERVISION OF

P. GHILAIN,

General Secretary of the Permanent Commission of the International Railway Congress Association.

(APRIL 1953)

016. 385. (02]

I. — BOOKS.

In French.

52 62 (08
MPAIN (L.).
étrologie d'atelier.
aris, Editions Eyrolles. Un volume (16.5 × 25 cm)
58 pages. (Prix : relié, 1 800 fr. fr.)

52 691
ÜARD (A.).
éton armé. Semelles. Poteaux. Nouveaux barèmes.
natures. Equarissage. Quantités de béton, d'acier et
offrages de 204 types de semelles. Armatures des
aux à charges centrées. Abaques de flambage et de
age des poteaux. Semelles sur deux et trois pieux.
ature des pieux.) 3e édition.
aris, Librairie Eyrolles, 61, boulevard Saint-Germain,
hez l'Auteur, 4, rue Paul-Barruel, Paris. Une brochure
× 31 cm) de 16 pages. (Prix : 650 fr. fr.)

52 621 .83
NRIOT (G.).
ours pratique sur les engrenages.
aris (17e), Société d'Etudes de l'Industrie de l'Engre-
, 48, boulevard des Batignolles. Un volume (155
25 mm) de 142 pages avec 132 figures. (Prix : relié,
fr. fr.)

52 624 (06
émoires de l'Association Internationale des Ponts
Charpentes. Douzième volume.
urich, publié par le Secrétariat général de l'Asso-
on, Ecole polytechnique fédérale. Un volume
× 24 cm) de 334 pages, illustré. En vente à la
airie Leeman, à Zurich et à *Technique et Documen-*
n, 11, rue Lavoisier, Paris (VIIIe). (Prix : 3 860 fr. fr.)

52 313 : 656
TIONS UNIES. COMMISSION ÉCONOMIQUE
POUR L'EUROPE. DIVISION DES TRANS-
PORTS.
ulletin Annuel de Statistiques de Transports, 1951.
enève, édité par l'organisme ci-dessus. *(Textes*
ais et français). Une brochure (21.5 × 26 cm) de
pages, avec de nombreux tableaux.

1952 691
PASQUET (J.).
L'exécution du béton sur les chantiers. *Essai de présentation simple des problèmes de pratique courante.*
Paris, Gauthier-Villars, 55, quai des Grands-Augustins. Un volume in-8°, XII-131 pages avec 15 figures. (Prix : 800 fr. fr.)

In German.

1952 669
BRANDENBERGER (E.).
Allgemeine Metallkunde.
Basel, Verlag von E. Reinhardt. Ein Band (15 × 21 cm), von 334 Seiten mit 168 Abbildungsseiten. (Preis : 14 Schw. Fr.)

1952 621 .392
Dipl. Ing. W. BRUNST.
Das elektrische Widerstandsschweissen.
Berlin, Springer Verlag. 290 Seiten. (Preis : D.M. 42.)

1952 624
Dr.-Ing. FISCHER (G.).
Beitrag zur Berechnung kreuzweise gespannter Fahrbahnplatten im Stahlbrückenbau.
Berlin, Verlag von W. Ernst & Sohn. Ein Band in-8°, 68 Seiten, mit 32 Abbildungen, 10 Tafeln und 2 Rechenbeispielen. (Preis : D.M. 10.)

In English.

1953 62
CREDE (C.E.).
Vibration and shock isolation.
London : Chapman and Hall, Limited, 37, Essex Street, W.C. 2. (Price : 52 s. net.)

1953 385 (09
FREEMAN ALLEN (G.).
Railways the World Over.
London : Ian Allan, Limited, Craven House. One volume (11 × 8 ½ in.) of 128 pages. (Price : 12 s. 6 d.)

---

(1) The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress
intly with the Office Bibliographique International, of Brussels. (See « Bibliographical Decimal Classification as applied to Railway
ce », by L. WEISSENBRUCH, in the number for November 1897, of the *Bulletin of the International Railway Congress*, p. 1509.)

1952 **621 .392**
FUCHS (E.) and BRADLEY (H.).
Welding practice. Vol. II : *Welding of ferrous metals.*
London : Published, in association with Imperial Chemical Industries, Limited, by Butterworth's Scientific Publications, Limited, Bell-Yard, Temple Bar, W.C. 2. (Price : 22 s. 6 d.)

1952 **621 .132.1 (42)**
POULTNEY (E.C.).
British express locomotive development, 1896-1948.
London : George Allen and Unwin, Limited, Ruskin House, 40, Museum Street, W.C. 1. (Price : 21 s. net.)

1952 **656**
SANDERSON (H.F.).
Railway commercial practice. Vol. I : *General an*
Passenger.
Demy 8vo, 270 pages, 33 plates. (Price : 25 s. ne
Vol. II : *Freight.*
Demy 8vo, 328 pages, 17 plates. (Price : 30 s. ne
London : Chapman & Hall Limited, Publisher
37, Essex Street, W.C. 2.

1952 **55 & 721**
TSCHEBOTARIOFF (G.P.).
Soil mechanics, foundations and earth structure
New York : McGraw Hill Book Company, In
One volume of 655 pages, with 404 figs and 27 table
(Price in U.S.A. : $ 6.50.)

[**016.** 385. (05]

II. — PERIODICALS.

In French.

Annales des ponts et chaussées. (Paris.)

1952 **691**
Annales des ponts et chaussées, novembre-décembre, p. 717.
LEZY (R.). — **Détermination du dosage d'un béton hydraulique à compacité optimum.** (6 000 mots & fig.)

Bulletin des C.F.F. (Berne.)

1952 **656** .254 (494)
Bulletin des C.F.F., novembre, p. 194.
MARTHALER (H.). — **Nouveau dispositif d'annonce des trains aux passages à niveau.** (300 mots & fig.)

1952 **621** .335 (494)
Bulletin des C.F.F., décembre, p. 204.
MEYER (E.). — **Nouvelle locomotive lourde pour les trains directs de la ligne du Saint-Gothard.** (1 500 mots & fig.)

1952 **656** .223.2 (4)
Bulletin des C.F.F., décembre, p. 206.
TRIBELHORN (W.). — La **convention « EUROP » pour les wagons.** (1 600 mots.)

1952 **656** .257 (494)
Bulletin des C.F.F., décembre, p. 210.
WINIGER (F.-J.). — **Les installations de sécurité** du parcours en double voie Oensingen-Olten-Hammer. (1 200 mots & fig.)

Bulletin de Documentation de l'U. I. C. (Paris.)

1952 **625** .286
Bulletin de Documentation de l'U.I.C., novembre, p. 122.
L'omnibus sur rail à moteur Diesel. (1 200 mots & fig.)

1952 **621** .
Bulletin de Documentation de l'U.I.C., décembr
p. 135.
Etat actuel et importance de la traction électriq
dans le trafic ferroviaire moderne. (1 500 mots, tableau
& fig.)

Bulletin des Transports Internationaux par Chemins de fer. (Berne.)

1952 **385** .62 & **385** .
Bull. des transp. intern. par Chemins de fer, octobr
p. 256.
Extrait du **rapport de gestion de l'Office Central d**
Transports internationaux par Chemins de fer po
l'année 1951. (2 500 mots & tableaux.)

1952 **621** .13 (4) & **625** .2 (
Bull. des transp. intern. par Chemins de fer, octobr
p. 262.
Le **matériel roulant des Chemins de fer en Europ**
(2 000 mots.)

1952 **385** .62 & **385** .
Bull. des transp. intern. par Chemins de fer, novembr
p. 275.
Les **travaux de la 5e Conférence de révision de**
CIM et de la CIV. (2 500 mots.)

1952 **385** .62 & **385** .
Bull. des transp. intern. par Chemins de fer, novembr
p. 281.
Longueurs kilométriques des lignes auxquelles s'ap
pliquent la **CIM** et la **CIV.** (200 mots et deux tableaux

---

1952 **656** .223
Bull. des transp. intern. des Chemins de fer, novemb
(annexe).
Règlement international concernant le transport d
wagons de particuliers (1er janvier 1953). (Annexe V
à la CIM du 23 novembre 1933.)(1 000 mots.)

52 **656** .225 & **656** .261
des transp. intern. par Chemins de fer, novembre, *(annexe)*.
glement international concernant le **transport des iners** (1er janvier 1953.) Annexe IX à la CIM du ovembre 1933. (600 mots.)

Génie Civil. (Paris.)

52 **625** .2 (0 (44)
e Civil, n° 3339, 15 décembre, p. 471.
banc d'essais sous charges verticales et le **banc ompression de 900 t** de la S.N.C.F., à Vitry-sur-. (2 000 mots & fig.)

53 **624** (44) & **691** (44)
e Civil, n° 3340, 1er janvier, p. 1.
RODIN (M.). — La **passerelle en béton précon-** t des Rocs, à Poitiers. (3 000 mots & fig.)

53 **621** .3 (06
e Civil, n° 3340, 1er janvier, p. 6.
14e Session de la **Conférence Internationale** des **ıds Réseaux électriques** (Paris, 28 mai-7 juin 1952). 0 mots.)

L'Ossature métallique. (Bruxelles.)

52 **624** (493)
ssature métallique, décembre, p. 599.
UMONT (H.). — Quelques réflexions concernant **ouveau Règlement belge pour la construction** des **métalliques.** (500 mots & fig.)

52 **62** (01 & **669**
ssature métallique, décembre, p. 602.
AES (L.). — Contribution à l'étude des critères de **ésistance statique des matériaux métalliques.** (4 000 & fig.)

vue Générale des Chemins de fer. (Paris.)

52 **625** .232 (44)
ue générale des Chemins de fer, décembre, p. 517.
UFOUR (E.) & FOY (P.). — Les **voitures à ossature cier inoxydable** de la S.N.C.F. (4 000 mots & fig.)

52 **385** (09 (436)
ue générale des Chemins de fer, décembre, p. 529.
ELMAS. — Les **Chemins de fer Fédéraux Autri-** ıs. (7 000 mots, tableaux & fig.)

52 **625** .241
ue générale des Chemins de fer, décembre, p. 549.
CHAERRER & WERNER. — Un **nouveau wagon de grande longueur pour charge de 20 tonnes par u.** (1 000 mots & fig.)

52 **656** .231 (45)
ue générale des Chemins de fer, décembre, p. 557.
MMONOT. — La **réforme tarifaire** des Chemins er Italiens au 1er février 1952. (700 mots & fig.)

Revue universelle des Mines. (Liège.)

1952 **625** .213
Revue universelle des Mines, août, p. 303.
DEHALU (J.-M.) — **L'amortissement des systèmes à double suspension. Son influence sur le confort des véhicules.** (10 000 mots & fig.)

1952 **669** .1
Revue universelle des Mines, novembre, p. 438.
LANGERS (R.), HERBIET (H.) & MONTBRUN (F.). — Etude des propriétés mécaniques et de l'aptitude à la déformation à froid de l'**acier Thomas amélioré.** (4 000 mots & fig.)

Trains. (Bruxelles.)

1952 **656** (493)
Trains, n° 10, p. 23.
DELORY (F.). — La **coordination des transports.** (1 500 mots.)

1952 **656** .261 (493)
Trains, n° 10, p. 33.
FIERS (J.). — Les **centres routiers et la réorganisation du service des messageries** à la S.N.C.B. (4 000 mots & fig.)

1952 **656** .237 (493)
Trains, n° 10, p. 41.
GONTIE (K.). — L'**organisation comptable industrielle et le contrôle budgétaire** à la S.N.C.B. (2 000 mots.)

Les Transports publics. (Lausanne.)

1952 **624** (494) & **691** (494)
Les Transports publics, octobre, p. 8.
L'**enlèvement de la rouille** au Viaduc de la Sitter. (Chemin de fer Bodensee-Toggenbourg). (500 mots & fig.)

La Vie du Rail. (Paris.)

1952 **385** (09 (494)
La Vie du Rail, 22 décembre, p. 3.
REICHEN (L.). — **Cinquante ans d'exploitation** des Chemins de fer Fédéraux Suisses. (1 200 mots & fig.)

1952 **625** .164
La Vie du Rail, 15 décembre, p. 3; 22 décembre, p. 8.
Trains et neige. (3 000 mots & fig.)

1953 **385** (09 (494)
La Vie du Rail, 5 janvier, p. 3; 12 janvier, p. 6; 19 janvier, p. 6; 26 janvier, p. 8.
Un réseau à voie métrique remarquable : Les **Chemins de fer Rhétiques.** (3 000 mots & fig.)

In German.

Der Eisenbahningenieur. (Frankfurt a. Main.)

1952 **625** .142.2
Der Eisenbahningenieur, Dezember, S. 250.
STEINWEDE (A.). — **Holzschutz vermindert Holzverbrauch.** (800 Wörter.)

1952 **625** .286

Der Eisenbahningenieur, Dezember, S. 257.

HINTERWÄLDER (K.). — Der **Schienenomnibus.** (1 000 Wörter & Abb.)

1952 **621** .135.2 (43)

Der Eisenbahningenieur, Dezember, S. 260.

SCHÜTZEICHEL (P.). — Die **Radreifenüberwachung der Lokomotiven** im Bahnbetriebswerk. (600 Wörter & Abb.)

1952 **621** .392 & **621** .7

Der Eisenbahningenieur, Dezember, S. 261.

RUPPIN (K.). — **Wirtschaftliche Widerstandsschweisstechnik** in Schmiedebetrieben des Fahrzeugbaues. (600 Wörter & 3 Tabellen.)

1952 **656** .27

Der Eisenbahningenieur, Dezember, S. 262.

WITTE (E.). — **Wirtschaftlichere Betriebsführung auf Nebenbahnstrecken.** (500 Wörter.)

1952 **625** .113

Der Eisenbahningenieur, Dezember, S. 263.

WARNICK (A.). — **Zulässige Pfeilhöhenfehler bei der Abnahme von Oberbauarbeiten** und bei Gleisabsteckungen. (1 000 Wörter & Abb.)

E.T.R. Eisenbahntechnische Rundschau. (Köln-Darmstadt.)

1952 **625** .13

Eisenbahntechnische Rundschau, Dezember, S. 405.

BIRKEL (F.). — Gegenwartsaufgaben im **Tunnelbau.** (6 000 Wörter & Abb.)

1952 **625** .13 (43)

Eisenbahntechnische Rundschau, Dezember, S. 415.

BREYER (H.). — **Geologische Verhältnisse der deutschen Eisenbahntunnel.** (5 000 Wörter.)

1952 **625** .13 (436)

Eisenbahntechnische Rundschau, Dezember, S. 421.

HANKER (R.). — Der **neue Semmeringtunnel.** Bau einer neuen Röhre und Instandsetzung des alten Tunnels. (9 000 Wörter & Abb.)

1952 **625** .13

Eisenbahntechnische Rundschau, Dezember, S. 437.

BERGER (H.). — Anregungen aus dem Bau von Wasserstollen für den **Eisenbahn-Tunnelbau.** (7 000 Wörter & Abb.)

1952 **625** .13

Eisenbahntechnische Rundschau, Dezember, S. 449.

KLEIN (R.). — Grundsätzliches über **Torkretarbeiten im Tunnelbau.** (5 500 Wörter & Abb.)

1952 **625** .13

Eisenbahntechnische Rundschau, Dezember, S. 458.

OHLEMUTZ (A.). — Erfahrungen mit **Torkretarbeiten in Tunneln.** (4 000 Wörter & Abb.)

Elektrische Bahnen. (München.)

1952 **621** .335 (4

Elektrische Bahnen, November, S. 269; Dezemb
S. 301.

BREYER (W.). — Das **Elektrolokomotiv-Baup gramm** der Österreichischen Bundesbahnen. (4 5 Wörter & Abb.)

1952 **621** .3

Elektrische Bahnen, November, S. 275.

KNIFFLER (A.). — **Elektrische Nutzbremsung** Nahverkehr auf Wechselstrombahnen. (4 000 Wört & Abb.)

1952 **621** .3

Elektrische Bahnen, November, S. 281.

HEIDE (E.). — Das **Verhalten des Fahrdrahtes** statischer und elektrischer Belastung. (2 000 Wört & Abb.)

1952 **625** .234 (4

Elektrische Bahnen, November, S. 285.

KÜHN (E.). — Betrachtungen über die **Beleuchtu in Eisenbahnwagen,** Rückblick und Ausblick auf Entwicklung in Deutschland. (2 500 Wörter & Ab

Glasers Annalen. (Berlin.)

1952 **625** .2

Glasers Annalen, November, S. 245.

MUNDT (R.). — **Wälzlager in Schienenfahrzeuge** (8 000 Wörter & Abb.)

1952 **625** .2

Glasers Annalen, November, S. 255.

Dr. BÄSELER. — **Handgesteuerter Kurvenlauf.** (6 Wörter & Abb.)

1952 **621** .135.4 & **625** .2

Glasers Annalen, November, S. 256.

FEYL (E.). — Kennzahlen für die **Beanspruchu von Gleisen und Fahrzeugen in Bogenstrecken.** (1 2 Wörter, 1 Tabelle & Abb.)

1952 **625** .143

Glasers Annalen, November, S. 259.

BLUME (J.). — **Riffeln leicht zu beseitigen?** (Zuschr zum Aufsatz von Prof. Dr .BÄSELER). (2 500 Wörte

Verkehr. (Wien.)

1952 **656** .21 (49

Verkehr, Nr 44, 1. November, S. 1462.

WICHSER (O.). — Die **Erweiterung des Bahnhof Buchs** (St. G.). (1 000 Wörter & Abb.)

1952 **656** .223.2 (

Verkehr, Nr 44, 1. November, S. 1463.

KNAP (H.). — **Güterwagenpool** und Montanunio (800 Wörter.)

1952 **385** (09 (46

Verkehr, Nr 45, 8. November, S. 1489.

KÜBLER (E.). — **Spanische Eisenbahnen.** (1 5 Wörter.)

1952 **656** .2

Verkehr, Nr 48, 29. November, S. 1593.

SKOFIZH (H.). — **Moderne Schadensverhütung** i **Güterverkehr.** (1 200 Wörter.)

In English.

The Engineer. (London.)

952 **625** .212 (42)
Engineer, December 5, p. 753.
railway wheel making plant. (4 800 words & figs.)

952 **621** .132.1 (42)
Engineer, December 12, p. 802.
OULTNEY (E.C.). — **Notable locomotives of 1902.**
00 words & figs.)

952 **624** .63 (42)
Engineer, December 12, p. 805.
prestressed concrete railway bridge. (1 800 words
figs.)

952 **621** .132.1 (42)
Engineer, December 19, p. 833.
tandard class « 4 » 2-6-0 locomotives. (400 words
fig.)

952 **621** .335 (43)
Engineer, December 26, p. 871.
ligh-speed electric mono-railway. (900 words & figs.)

Engineering. (London.)

952 **625** .162 (42)
gineering, November 28, p. 703.
lluminated lifting barriers for railway level crossing.
0 words & fig.)

952 **625** .212 (42)
gineering, December 5, p. 713; December 12, p. 752.
orge for continuous production of **solid railway**
eels and disc centres. (8 000 words & figs.)

952 **656** .22
gineering, December 5, p. 717.
UBOIS (Fr.). — **Automatic computation of railway**
in schedules. (2 100 words & figs.)

952 **625** .171 (42)
gineering, December 12, p. 766.
ecording the condition of railway track. (500 words
fig.)

952 **621** .39 (42)
gineering, December 12, p. 774.
50-KV X-Ray equipment for the **radiography of**
ds. (1 400 words & figs.)

952 **621** .336 (42)
gineering, December 26, p. 819.
verhead equipment for direct-current electric traction.
0 words.)

952 **621** .431.72 (494)
gineering, December 26, p. 830.
orty years of Sulzer **Diesel rail traction.** (2 500 words
figs.)

1953 **621** .33 (42)
Engineering, January 2, p. 12.
Overhead construction for 50 cycle single-phase traction. (400 words & fig.)

1953 **621** .132.1 (42)
Engineering, January 2, p. 13.
Class 4 standard 2-6-0 locomotive; British Railways. (1 400 words & figs.)

Proceedings of the Institution of Civil Engineers. (London.)

1953 **721** .1
Proceedings of the Institution of Civil Engineers, Part 1, January, p. 43.
MORGAN (H.D.) and HASWELL (C.K.). — **The driving and testing of piles.** (33 pages, illustrated.)

The Journal of the Institute of Transport. (London.)

1952 **385** (09 (42)
The Journal of the Institute of Transport, November, p. 13.
WILLIAMS (B.R.). — **Nationalisation and after.** (3 800 words.)

1953 **656**
The Journal of the Institute of Transport, January, p. 35.
MENZLER (F.A.A.). — **Statistical methods and operational research in transport.** (8 400 words, tables and diagrams.)

The Proceedings of the Institution of Electrical Engineers. (London.)

1953 **621** .3 (42)
Proceedings of the Institution of Electrical Engineers, January, p. 26.
Discussion on « **Railway electrification in Great Britain** ». (7 400 words.)

The Locomotive. (London.)

1952 **621** .132.1 (62) & **621** .133.1 (62)
The locomotive, December, p. 184.
Sudan Railways. — Oil-burning 2-8-2 locomotives. (900 words & figs.)

1952 **621** .431. 72 (5)
The Locomotive, December, p. 191.
1 000 H.P. Diesel-electric locos for Ceylon. (1 200 words & figs.)

Modern Transport. (London.)

1952 **621** .431.72 (42)
Modern Transport, November 15, p. 13.
Diesel railcars for British Railways. (400 words & figs.)

1952 **621** .431.72 (59)

Modern Transport, November 29, p. 3.

Diesel-electric units for Ceylon. New Brush-Bagnall 1 000 H.P. locomotives. (1 200 words & figs.)

1952 **625** .13 (42)

Modern Transport, November 29, p. 8.

Repairing a cast iron bridge. L.M.R. adopts an unusual method (600 words & fig.)

1952 **656** .254 (42)

Modern Transport, December 6, p. 5.

Preselective signalbox. Push-button equipment at Ealing. (400 words & figs.)

The Oil Engine and Gas Turbine. (London.)

1952 **621** .431.72 (5)

The Oil Engine, December, p. 274.

Ceylon's 25 new locomotives. (2 000 words & figs.)

1952 **621** .431.72 (42)

The Oil Engine, December, p. 277.

British Railways' railcar programme. (1 100 words & figs.)

1952 **621** .438 (73)

The Oil Engine, December, p. 303.

Gas-turbine locomotives on the Union Pacific. (400 words & fig.)

1953 **621** .431.72 (44)

The Oil Engine, January, p. 318.

French railcar types standardized. (1 000 words & figs.)

Railway Age. (New York.)

1952 **656** .212. (73)

Railway Age, November 3, p. 73.

$ 3.6-million yard improves service for Jersey Central patrons. (1 300 words & figs.)

1952 **656** .212 (73)

Railway Age, November 3, p. 78.

« J » spends $ 4.4 million to build **more efficiency into Kirk yard.** (2 200 words & figs.)

1952 **656** .212 (73)

Railway Age, November 3, p. 82.

Modernized Kirk yard... How it promotes efficient operation. (1 200 words & figs.)

1952 **656** .212 (73)

Railway Age, November 10, p. 55.

The Southern's Ernest Norris yard. (3 000 words & figs.)

1952 **656** .212.5 (73) & **656** .254 (73)

Railway Age, November 10, p. 60.

Modern retarders and communications in Ernest Norris yard. (1 200 words & figs.)

1952 **625** .243 (7

Railway Age, November 17, p. 58.

For the Western Pacific..., **another 20 compartmentize cars.** (300 words & figs.)

Railway Engineering and Maintenance. (Chicago.)

1952 **625** .144.1 (7

Railway Engineering and Maintenance, Decembe p. 1181.

CRI & P works out new variation in loading **welde rails.** (1 200 words & figs.)

1952 **625** .142 (7

Railway Engineering and Maintenance, Decembe p. 1193.

BLAIR (T.-A.). — **Reasons for failure prove guide t solution of crosstie problem.** (900 words & tables.)

The Railway Gazette. (London.)

1952 **621** .13

The Railway Gazette, December 5, p. 626.

Locomotive coupling rods. (500 words.)

1952 **625** .21

The Railway Gazette, December 5, p. 628.

Rolling stock wheel manufacture. (3 600 words & figs

1952 **621** .132.8 (5) & **621**. 133.1 (5

The Railway Gazette, December 5, p. 634.

New locomotives for Iraq. (1 000 words & figs.)

1952 **656** .283 (42

The Railway Gazette, December 5, p. 638.

Ministry of Transport accident report : Piershi Junction, December 21, 1951. — British Railways Scottish Region. (400 words & figs.)

1952 **625** .13 (42

The Railway Gazette, December 19, p. 682.

Unusual repair of bridge girder. (600 words & fig

1952 **625** .162 (42

The Railway Gazette, December 19, p. 683.

Electric drive for crossing barriers. (400 words & fig

1952 **656** .254 (42

The Railway Gazette, December 19, p. 684.

Power signalling at Euston, London Midland Region (3 000 words & figs.)

1952 **625** .234 (42

The Railway Gazette, December 26, p. 710.

Boilers for train heating. (800 words & fig.)

1952 **621** .335 (494

The Railway Gazette, December 26, p. 712.

New locomotives for Gotthard line-2. *(Concluded.* (1 600 words & figs.)

1952 **621** .33 (42)
The Railway Gazette, December 26, p. 715.
First British 50-cycle electrification. (400 words & fig.)

1952 **625** .13 (73)
The Railway Gazette, December 26, p. 716.
New tunnel near Clarksburg, B. & O. Railroad. (400 words & figs.)

1952 **656** .222.5 (42)
The Railway Gazette, December 26, p. 718.
Recorded broadcasts in the « Hook Continental ». (500 words & figs.)

Diesel Railway Traction. (London.)

1953 **621** .431.72 (5)
Diesel Railway Traction, January, p. 5.
Main-line Diesel locomotives for Ceylon. (1 900 words & figs.)

1953 **621** .431.72 (73)
Diesel Railway Traction, January, p. 13.
Four-unit locomotives in the U. S. A. (300 words & ig.)

The Railway Magazine. (London.)

1953 **621** .132.1 (42)
The Railway Magazine, January, p. 3.
WEBB (DAVID R.). — **British 0-6-4 tank locomotives.** (1 400 words & figs.)

Railway Mechanical and Electrical Engineer. (New-York.)

1952 **621** .133 (06 (73)
Railway Mechanical and Electrical Engineer, November, p. 61.
Boiler Makers celebrate 50 years of service. (4 400 words & figs.)

1952 **625** .25 (06 (73)
Railway Mechanical and Electrical Engineer, November, p. 85.
Diversified program at 1952 air brake meeting. (5 000 words & figs.)

1952 **621** .431.72 (73)
Railway Mechanical and Electrical Engineer, December, p. 59.
2 400 horsepower Hood-type locomotive. (1 800 words & figs.)

1952 **625** .23 (73)
Railway Mechanical and Electrical Engineer, December, p. 66.
Great Northern rebuilds old **passenger cars.** (900 words & figs.)

1952 **625** .24 (73)
Railway Mechanical and Electrical Engineer, December, p. 70.
Box car upgrading on the C. & O. (2 000 words & figs.)

1952 **656**. 212.7 (73)
Railway Mechanical and Electrical Engineer, December, p. 77.
Freighthouse electrical equipment. (2 200 words & figs.)

In Spanish.

Boletin de la Asociación permanente del Congreso Panamericano de Ferrocarriles. (Buenos-Aires.)

1952 **621** .13
Boletin de la Asoc. perman. del Congreso Panameric. de Ferrocarriles, septiembre-octubre, p. 29.
CHAPELON (A.). — **La locomotora a vapor. Su estado actual y las posibilidades del futuro.** (12 000 palabras & fig.)

Ferrocarriles y Tranvias. (Madrid.)

1952 **625** .215
Ferrocarriles y Tranvias, noviembre, p. 401.
LAFFITTE (C.). — Observaciones sobre los **carretones de los coches de viajeros.** (1 000 palabras & fig.)

1952 **621** .133.1 & **621** .134.5
Ferrocarriles y Tranvias, noviembre, p. 403.
GALAN GUERRERO (A.). — Algunos comentarios sobre **el consumo especifico de las locomotoras de vapor.** (2 500 palabras.)

In Italian.

Giornale del Genio Civile. (Roma.)

1952 **624** .63 (45)
Giornale del Genio Civile, ottobre, p. 584.
TACCONI (G.). — **Ricostruzione del ponte sul fiume** Vara in località piana Battolla-La Spezia. (1 500 parole & fig.)

Ingegneria ferroviaria. (Roma.)

1952 **621** .133.1
Ingegneria ferroviaria, novembre, p. 780.
PADOVANI (C.), SINIRAMED (P. I. C.) & STRAMBI (E.). — Contributo allo studio di un **metodo normalizzato per la determinazione delle sostanze volatili.** (2 500 parole & tabelle.)

1952 **621** .332 (45)
Ingegneria ferroviaria, novembre, p. 787.
PROSPERI (L.). — Come le vigenti norme legislative per l'**esecuzione delle linee elettriche aeree esterne regolano gli attraversamenti.** (4 500 parole, tabelle & fig.)

1952 **625** .236

Ingegneria ferroviaria, novembre, p. 813.

de PALMA (L.). — **I moderni sistemi di « disinfestazione »**. Loro impiego nelle ferrovie. (800 parole & fig.)

Politica dei Trasporti. (Roma.)

1952 **621** .431.72

Politica dei Trasporti, novembre, p. 459.

STAGNI (E.), CAMPOSANO (P.,) & MELANI (F.). — **L'alleggerimento nelle costruzioni di automotrici con motore a combustione interna.** (2 000 parole & fig.)

1952 **656**

Politica dei Trasporti, novembre, p. 463.

SANTORO (F.). — Sulla più conveniente **distribuzione del traffico tra strada e rotaia.** (5 000 parole.)

In Netherlands.

Spoor- en Tramwegen. (Utrecht.)

1953 **385** (09 (49

Spoor- en Tramwegen, N^{r} 1, 8 Januari, p. 2.

De Nederlandsche Spoorwegen in 1952. (2 000 woorde & fig.)

1953 **625** .

Spoor- en Tramwegen, N^{r} 1, 8 Januari, p. 7.

BIEZEVELD (L.J.). — Een Engelse beschouwin over de **keuze tussen stoom- electrische- en dieseltracti** (2 000 woorden & tabellen.)

1953 **656** (4

Spoor- en Tramwegen, N^{r} 1, 8 Januari, p. 10.

FLIPSE (J.L.). — **De coordinatie van het verkeer** i Duitsland. (1 200 woorden.)

M. Weissenbruch & Co., Ltd., Printer to the King, 49, rue du Poinçon, Bruxelles.

MONTHLY BIBLIOGRAPHY OF RAILWAYS(1)

PUBLISHED UNDER THE SUPERVISION OF

P. GHILAIN,

General Secretary of the Permanent Commission of the International Railway Congress Association.

(MAY 1953)

[016. 385. (02]

I. — BOOKS.

In French.

1953 691
AURY (J.).
Le béton. Préface de A. Caquot. 3e édition.
Paris, Dunod, éditeur. Un volume (14 × 22 cm) de 04 pages, avec 37 figures. (Prix : 940 fr. fr.)

1953 62 (0
MASSON (H.).
Le calcul graphique à l'usage des ingénieurs (sans querre, ni compas, ni tire-ligne).
Paris, Editions Eyrolles, 61, boulevard Saint-Germain. n volume broché (16.5 × 25 cm) de 134 pages, avec 5 figures dans le texte et sur deux feuilles dépliantes ors-texte. (Prix : 950 fr. fr.)

1952 53
MOLES (A.).
Physique et technique du bruit.
Paris, Dunod, éditeur. Un volume broché (14 × 2 cm) de 156 pages, avec 125 figures. (Prix : 960 fr. fr.)

1952 62 (03
PIRAUX (H.).
Dictionnaire anglais-français des termes relatifs à l'élec- rotechnique, l'électronique et aux applications connexes.
Paris, Editeur Eyrolles, 61, boulevard Saint-Germain. n volume (16 × 25 cm) de 296 pages. (Prix : 1 850 fr.fr.)

1953 536
ROCARD (Y.).
Thermodynamique.
Paris, Masson, éditeur. Un volume (17 × 25 cm) de 552 pages, avec 271 figures. (Prix : broché, 3 650 fr.fr.; artonné, 4 150 fr. fr.)

In German.

1953 656 (43)
BRANDT (L.).
Schiene und Strasse 1952.
Dortmund, Verkehrs- und Wirtschaftsverlag. Ein Band Din A 4, 206 Seiten, davon Textteil 137 Seiten. (Preis : Inland, 6.— D.M.)

1953 721 .9
SATTLER (K.).
Theorie der Verbundkonstruktion.
Berlin- Wilmersdorf, Verlag von Wilhelm Ernst & Sohn. Ein Band (17 × 24 cm), 300 Seiten mit 90 Abbildungen und 56 Tafeln. (Preis : 43.— D.M.)

1952 624
STAMM (C.).
Brückeneinstürze und ihre Lehren.
Zürich, Verlag Leeman. Ein Band (15.5 × 22.5 cm), 100 Seiten mit zahlreichen Abbildungen. (Preis : 12.50 Schweiz. Fr.)

In English.

1953 656 .2 (42)
AHRONS (E.L.).
Locomotive and train working in the latter part of the nineteenth century. Volume 4. *(Reprinted from the Railway Magazine.)*
Cambridge (England), W. Heffer & Sons, Ltd.

1953 656 .25 (73)
Association of American Railroads. — Signal Section. — Proceedings. Minutes. Fifty-fourth Annual Meeting, Quebec, Que. Canada, September 29, 30 and October 1, 1952. Vol. XL IX, No. 2.
One brochure of 95 pages, illustrated, published by the Signal Section, A.A.R., 59, East Van Buren Street, Chicago 5, Ill.

1952 385 (061.4 (73)
American Railway Engineering Association. — Bulletin. December. Vol. 54. No. 505.
Reports of Committees : Impact and bridge stresses. — Ties. — Maintenance of way work equipment. — Wood preservation. — Economics of railway labour. — Masonry. — Waterproofing. — Clearances.
One brochure of 219 pages, published by the American Railway Engineering Association, 59, East Van Buren Street, Chicago, 5, Ill.

1953 691
BILLIG (K.).
Prestressed concrete.
London, Macmillan and Co., Ltd., St. Martin's Street, W.C. 2. (Price : 36 s.)

---

(1) The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress onjointly with the Office Bibliographique International, of Brussels. (See « Bibliographical Decimal Classification as applied to Railway cience », by L. WEISSENBRUCH, in the number for November 1897, of the *Bulletin of the International Railway Congress*, p. 1509.)

1953 **385** (09 (42)
BOYD (J.I.C.).
Narrow gauge rails in Mid. Wales. One volume (8 ½ × 5 ½ in.) of 146 pages, illustrated.
South Godstone (Surrey), The Oakwood Press. (Price : 22 s. 6 d.)

1953 **691**
CHAMPION (F.A.).
Corrosion testing procedures.
London, Chapman and Hall, Ltd., 37, Essex Street, Strand, W.C. 2. (Price : 36 s. net.)

1953 **621** .132.1 (42)
POULTNEY (E.C.).
British express locomotive development 1896-1948.
London : George Allen and Unwin Ltd., Ruskin House, 40, Museum Street, W.C. 1. (Price : 21 s.)

1952 **62** (01 & **669**
University of Illinois Bulletin. Bulletin Series No. 402.
WILSON (W.M.), MUNSE (W.H.) and CAYCI (M.A.).
A study of the practical efficiency under static loading of riveted joints connecting plates.
A brochure of 75 pages, illustrated, published by the University of Illinois, 358, Administration Building, Urbana Ill. (Price : 75 cents.)

1953 **656** ..
World Railways 1952-1953. 2nd edition.
London : Sampson Low, Marston & Co., Ld 25 Gilbert Street, W.1. — One volume of 550 page of text matter with nearly 1 000 illustrations. (Price £ 4.4.0 d. net.)

In Italian.

1952 **69**
CESTELLI GUIDI (C.).
Punto di vista sul « precompresso ». Il cemento armat precompresso. — Teoria, esperienze, applicazion 2° ed.
Milano, Hoepli, editore. Un volume di 355 pagin con 235 illustrazioni.

1953 **625** .1 (45) & **625** .2 (4
Dr. Ing. G. di RAIMONDO.
Sguardo panoramico all' attività delle F. S. nel anno 1952. (Estratto da : *Ingegneria Ferroviaria*, n. gennaio 1953).
Roma, *Ingegneria Ferroviaria*, Piazza Croce Ross Un opuscolo di 30 pagine con 30 figure & tavole.

[**016.** 385. (05]

II. — PERIODICALS.

In French.

Bulletin des C.F.F. (Berne.)

1953 **725** .31 (494)
Bulletin des CFF, janvier, p. 6.
FRANEL. — **Rénovation des bâtiments aux voyageurs** du Ier Arrondissement. (500 mots & fig.)

1953 **656** .254 (494)
Bulletin des CFF, janvier, p. 10.
WINIGER (F.J.). — **Signaux d'avertissement pour passages à niveau** de lignes à double voie. (1 000 mots & fig.)

Bulletin des Transports Internationaux par Chemins de fer. (Berne.)

1952 **656** .24
Bull. des transp. intern. par Chemins de fer, décembre, p. 39.
CHIMENTI (E.). — La **responsabilité extra-contractuelle du chemin de fer** pendant l'exécution du contrat de transport de choses. (1 700 mots.)

Bulletin de l'Union des Exploitations électriques en Belgique. (Bruxelles.)

1952 **621** .33 (493) & **625** .1 (493)
Bull. de l'Union des Exploit. électr. en Belgique, novembre, p. 26.
Les **Chemins de fer, la Jonction et l'électrification.** (1 000 mots.)

Containers. (Paris.)

1952 **656** .225 (43) & **656** .261 (4
Containers, n° 8, décembre, p. 26.
Extension en Allemagne du **trafic des grands conta ners.** (1 000 mots & tableaux.)

1952 **656** .225 & **656** .26
Containers, n° 8, décembre p. 30.
Petits containers pour fruits et légumes. (500 mots fig.)

Economie et Technique des Transports. (Zürich.)

1952 **621** .138.5 & **625** .
Economie et Technique des Transports, nos 10-12, p. 10
KALLENBACH (H.A.). — **Rationelle Reinigung methoden** bei Verwendung entsprechender Spezia maschinen in Reparaturwerkstätten der Verkehr betriebe. (2 500 Wörter & Abb.)

1952 **621** .3
Economie et Technique des Transports, nos 10-12, p. 10
KIPFER (V.). — Neue Wege im Bau von **elektrisch Fahrleitungen.** (800 Wörter & Abb.)

1952 **385** .
Economie et Technique des Transports, nos 10-12, p. 11
HUG (Ad.-M.). — De quelques particularités q influencent l'**économie de l'exploitation de chemins fer** *(suite et fin)*. (1 000 mots & fig.)

Génie Civil. (Paris.)

1953 **62** (01
énie Civil, nº 3341, 15 janvier, p. 26.
VALLETTE (R.). — **Le cisaillement et le glissement existent pas.** (2 500 mots & fig.)

1953 **385** (09 (73)
énie Civil, nº 3341, 15 janvier, p. 29.
Les **chemins de fer aux Etats-Unis.** (2 000 mots).

1953 **691**
énie Civil, nº 3342, 1er février, p. 54.
COÜARD (A.). — La recherche des solutions éconoiques en **béton armé.** (600 mots.)

1953 **624** .51 (73)
énie Civil, nº 3343, 15 février, p. 69.
Le nouveau **pont suspendu** du Mémorial sur le Delaare (Etats-Unis). (1 500 mots & fig.)

L'Ossature métallique. (Bruxelles.)

1953 **624** & **669**
'Ossature métallique, janvier, p. 1.
LOUIS (H.). — **4e Congrès de l'A.I.P.C. Constructions étalliques.** Questions fondamentales. Rapport général. 000 mots & fig.)

1953 **624** & **691**
'Ossature métallique, janvier, p. 26.
SOETE (A.). — Note sur les **profils T enrobés de éton.** (1 600 mots & fig.)

1953 **691**
'Ossature métallique, janvier, p. 47; février, p. 98.
POURBAIX (M.). — Protection contre la corrosion. ue d'ensemble sur le **comportement électrochimique des étaux.** (6 000 mots & fig.)

Revue de l'Aluminium. (Paris.)

1952 **629** .113.62 (44) & **669** .71 (44)
evue de l'Aluminium, septembre, p. 308.
ALBERT (L.). — L'emploi systématique par la .A.T.P. des **fils de contact en aluminium-acier.** (1 000 ots & fig.)

1952 **625** .234 (44)
evue de l'Aluminium, octobre, p. 347.
Les Chemins de fer français emploient la **peinture luminium comme isolant thermique.** (1 000 mots, tableau fig.)

1952/53 **621** .392 & **669** .71
evue de l'Aluminium, novembre, p. 417; janvier, p. 35.
GUINARD (Ch.). — Le **soudage par résistance des étaux légers.** (3 500 mots & fig.)

Revue de l'Association française des Amis des Chemins de fer. (Paris.)

1952 **621** .431.72 (44)
evue de l'Association franç. des Amis des Ch. de fer, septembre-octobre, p. 117.
GACHE (A.). — Les **autorails** à la SNCF. (10 000 ots & fig.)

1952 **621** .431.72 (492)
Revue de l'Association franç. des Amis des Ch. de fer, septembre-octobre, p. 130.
NYMEYER (A.G.). — Note sur le **nouveau matériel Diesel pour les lignes secondaires** des Chemins de fer Néerlandais. (1 000 mots.)

1952 **656** .222.1 (73)
Revue de l'Association franç. des Amis des Ch. de fer, septembre-octobre, p. 134.
VUILLET. — Les **grandes vitesses** aux U.S.A. (300 mots et 4 tableaux.)

1952 **385** (09 (460)
Revue de l'Association franç. des Amis des Ch. de fer, novembre-décembre, p. 137.
VUILLET. — L'**effort de rénovation** du Réseau National des Chemins de fer Espagnols. (8 000 mots & fig.)

1952 **621** .33 (460)
Revue de l'Association franç. des Amis des Ch. de fer, novembre-décembre, p. 149.
CAIRE (D.). — L'**électrification** des Chemins de fer Espagnols. (2 000 mots, tableaux & fig.)

1952 **385** (09 (52)
Revue de l'Association franç. des Amis des Ch. de fer, novembre-décembre, p. 154.
ONO (Y.). — Les **Chemins de fer Japonais** et l'état actuel de leur reconstitution depuis la guerre. (2 000 mots & fig.)

Revue Générale des Chemins de fer. (Paris.)

1953 **621** .33 (44)
Revue générale des Chemins de fer, janvier, p. 1.
LEFORT. — **L'électrification des lignes du Nord-Est de la France.** (10 000 mots, tableaux & fig.)

1953 **656** .225 (44) & **656** .261 (44)
Revue générale des Chemins de fer, janvier, p. 23.
SCHAERRER et PALMIÉRI. — Les **remorques porte-wagons** à la SNCF. — La remorque française S.C.E.T.A. (type Arbel). (3 500 mots & fig.)

1953 **656** .211.5 (44) & **656** .224 (44)
Revue générale des Chemins de fer, janvier, p. 36.
FOURGEOT. — La **location des places** dans les trains en Savoie. (3 000 mots & fig.)

1953 **621** .33 (73)
Revue générale des Chemins de fer, janvier, p. 47.
L'extension de l'**électrification des chemins de fer aux Etats-Unis** et le courant à fréquence industrielle. (800 mots & tableau.)

1953 **621** .33 (492)
Revue générale des Chemins de fer, janvier, p. 48.
L'**électrification** des Chemins de fer Néerlandais. (500 mots & carte.)

Revue des Transports et des Communications. (Lake Success.)

1951 656 (54)
Revue des Transports et des Communications, n° 3, juillet-septembre, p. 21.

Les transports et les communications du Pakistan. (8 000 mots & carte.)

1951 656 (42)
Revue des Transports et des Communications, n° 3, juillet-septembre, p. 40.

CAMERON (A.). — Rôle de la Commission Britannique des Transports dans le **système de transports de la Grande-Bretagne.** (2 500 mots.)

1951 656 (73)
Revue des Transports et des Communications, n° 3, juillet-septembre, p. 43.

WILLIAMS (E.W.Jr.). — La **concurrence** entre les entreprises de transports aux Etats-Unis. (8 000 mots.)

Travaux. (Paris.)

1952 624 (06
Travaux, novembre, p. 503.

LAZARD (A.). — Le **IV^e^ Congrès de l'Association Internationale des Ponts et Charpentes.** (Cambridge-Londres, 25 août-5 septembre 1952). (6 000 mots.)

1952 691
Travaux, novembre, p. 523.

LARAVOIRE (L.). — Un nouveau produit sidérurgique français, le « fil machine » en acier traité pour **béton précontraint.** (3 000 mots & fig.)

1952 624 & 691
Travaux, novembre, p. 529.

CAPEL (J.). — Construction de huit nouveaux **ponts en béton précontraint.** (1 000 mots & fig.)

In German.

Der Eisenbahningenieur. (Frankfurt a. Main.)

1953 625 .1 (43) & 656 .25 (43)
Der Eisenbahningenieur, Januar, S. 2.

DOBMAIER (A.). — Der **Baudienst** der Deutschen Bundesbahn. (4 000 Wörter.)

1953 625 .2 (43)
Der Eisenbahningenieur, Januar, S. 6.

BRILL (A.). — **Vorschau für maschinentechnische Vorhaben** 1953. (2 500 Wörter.)

1953 656 .2 (43)
Der Eisenbahningenieur, Januar, S. 8.

JACOBSHAGEN (M.). — **Aufgaben des Betriebsdienstes** im Jahre 1953. (2 000 Wörter.)

1953 624 (43)
Der Eisenbahningenieur, Januar, S. 11.

ERNST (E.). — Der **gegenwärtige Stand des Brücken- und Ingenieurhochbaus** bei der Deutschen Bundesbahn une seine Aufgaben in den nächsten Jahren. (3 000 Wörter.)

1953 625 .14 (4
Der Eisenbahningenieur, Januar, S. 13.

SCHRAMM (G.). — Der **Oberbau** nach dem Krieg (2 500 Wörter & Abb.)

E.T.R. Eisenbahntechnische Rundschau. (Köln-Darmstadt.)

1953 625 .232 (94
Eisenbahntechnische Rundschau, Januar, S. 1.

BODE (A.). — **Reisezüge für Australien.** (2 600 Wört & Abb.).

1953 625 .143
Eisenbahntechnische Rundschau, Januar, S. 8.

KÜHNEL (R.). — Allgemeines über die **Herstellun des Schienenstahles.** (2 500 Wörter & Abb.)

1953 656 .2
Eisenbahntechnische Rundschau, Januar, S. 15.

KRAUSE (E.). — **Rationalisierung von Nebenbahne** (3 000 Wörter, Falttafel & Abb.)

1953 625 .142.4 (43) & 625 .144 (4
Eisenbahntechnische Rundschau, Januar, S. 27; F bruar, S. 66.

KUHN (F.). — **Verlegen von Betonschwellenoberba** mit Gross- und Kleingeräten. (7 000 Wörter & Abb

---

1953 621 .335 (4
Eisenbahntechnische Rundschau, Januar, S. 36.

DUVENBECK (B.). — **Neue elektrische Lokomoti** der Deutschen Bundesbahn. (1 000 Wörter & Abb

---

1953 625 .143.5 (4
Eisenbahntechnische Rundschau, Januar, S. 39.

SCHRÖDER (H.). — Zum Problem der **elastisch Zwischenlagen im Oberbau.** (2 000 Wörter & Abb.)

Elektrische Bahnen. (München.)

1952 621 .
Elektrische Bahnen, Dezember, S. 293.

KETTNER (K.). — **Prüfeinrichtungen für Gleichstro Streckenschalter.** (5 000 Wörter & Abb.)

1952 621 .3
Elektrische Bahnen, Dezember, S. 305.

LEBRECHT (L.) & GLAS (W.). — Zur Frage d **Umrichterbelastung von Netzen der öffentlichen Versc gung.** (2 000 Wörter & Abb.)

1952 621
Elektrische Bahnen, Dezember, S. 308.

ABLASSMEYER (H.). — **Lüftungsüberwachung einrichtung.** (600 Wörter & Abb.)

1952 621 .
Elektrische Bahnen, Dezember, S. 309.

HUNDERTSCHUH (A.). — Die Verwendung v 50 Hz. **Induktionszählern** im 16 2/3 Hz.-Netz. (1 5 Wörter & Abb.)

Glasers Annalen. (Berlin.)

1952 **621** .135 (01
lasers Annalen, Dezember, S. 265.
MUNKELT (K.). — **Lokomotiven im Betrieb auf**
nebenen Schienen. (7 000 Wörter & Abb.)

1952 **621** .132.8
lasers Annalen, Dezember, S. 275.
PFEIFER (J.). — Das Leistungsschaubild der **feuer-**
sen Lokomotive. (2 000 Wörter & Abb.)

1952 **656** .212.6 (43)
lasers Annalen, Dezember, S. 278.
MOTZ. — **Kostensenkung durch Elektrofahrzeuge**
d Behälter. (1 000 Wörter & Abb.)

1952 **621** .133.7
lasers Annalen, Dezember, S. 279.
LEHNER (A.). — Über die Entwicklung von **Nieder-**
hlagsvorwärmern für Lokomotiven. (2 000 Wörter &
bb.)

Internationales Archiv für Verkehrswesen. (Frankfurt-Main.)

1952 **621** .332 (43)
tern. Archiv. f. Verkehrswesen, Nr. 20, 2. Oktoberheft,
S. 473.
FRITSCHE (R.H.). — **Auswirkungen einer etwaigen**
nderung des deutschen Bahnstromsystems. (3 500 Wör-
r.)

1952 **656** (43)
tern. Archiv. f. Verkehrswesen, Nr. 21, 1. November-
heft, S. 497.
SEEBOHM (H.Ch.). — **Der Wiederaufbau des deut-**
hen Verkehrswesens in europäischer Sicht. (8 000
Vörter.)

1952 **656** .225
tern. Archiv. f. Verkehrswesen, Nr. 22, 2. November-
heft, S. 521.
UNVERZAGT (W.). — **Güterverkehr und Güter-**
nschlag im Wandel der Technik. (5 000 Wörter.)

1952 **656** (43)
tern. Archiv. f. Verkehrswesen, Nr. 24, 2. Dezember-
heft, S. 569.
HOFFMANN (R.). — **Verkehrsprobleme und Ver-**
ehrsplanung in Südostniedersachsen. (7 000 Wörter
Abb.)

Signal und Draht. (Frankfurt a. Main.)

1952 **656** .257 (43)
ignal und Draht, Dezember, S. 196.
KASTEN (R.). — **Neue Dr-Anlagen** auf Hbf Münster
Westf.). (2 000 Wörter & Abb.)

1952 **656** .25
ignal und Draht, Dezember, S. 199.
Zur Änderung der signaltechnischen Grundsätze im
usammenhang mit der Einführung neuer Signaltechnik.
A. « Übersichtlichkeit der Signalbilder », von H.
unze; *B.* « Das Ersatzsignal », von F. Lenhart;
. « Grundsätze für das Entwerfen von Signalschal-
ngen ». (4 000 Wörter & Abb.)

In English.

The Engineer. (London.)

1953 **621** .132.1 (42)
The Engineer, January 2, p. 2.
British-built locomotives of 1952. (3 600 words & figs.)

1953 **621** .132.1 (42)
The Engineer, February 6, p. 207.
Standard class « 2 » locomotives for British Railways.
(1 200 words & figs.)

1953 **621** .438 (73)
The Engineer, February 6, p. 219.
American gas turbines in 1952. (2 800 words & figs.)

1953 **621** .132.1 (42) & **621** .134.3 (42)
The Engineer, February 27, p. 326.
British locomotives fitted with cam poppet valve gear.
(1 200 words & figs.)

1953 **621** .438 (42)
The Engineer, February 20, p. 278; February 27, p. 327.
DYMOND (A.W.J.). — **Operating experiences with**
two gas turbine locomotives *(to be continued).* (3 900
words.)

Engineering. (London.)

1953 **625** .162 (42)
Engineering, January 9, p. 63.
Electrically-operated traffic barrier.(300 words & fig.)

1953 **62** (01 & 669
Engineering, January 16, p. 65; January 23, p. 100.
BOYD MURRAY (G.). —**The propagation of frac-**
tures in mild-steel plates. (9 600 words & figs.)

1953 **621** .133.3 (42)
Engineering, January 30, p. 144.
Gas-fired annealing of locomotive tubes. (300 words
& figs.)

1953 **621** .332 (442)
Engineering, February 6, p. 185.
Welded tubular steel gantry. (1 200 words & fig.)

Journal, The Institution of Locomotive Engineers. (London.)

1952 **625** .28
Journal, The Institution of Locomotive Engineers,
Vol. 42 (Part No. 4), p. 281.
COCK (C.M.). — **Motive power for railways.** (24 pages,
illustrated.)

1952 **621** .338 & **625** .215
Journal, The Institution of Locomotive Engineers,
Vol. 42 (Part No. 4), p. 306.
GRAFF-BAKER (W.S.). — Considerations on **bogie**
design with particular reference to electric railways.
(56 pages, illustrations.)

1952 **621** .33 (494)
Journal, The Institution of Locomotive Engineers, Vol. 42 (Part No. 4), p. 362.
LOOSLI (H.). — **Railway electrification** in Switzerland, with special reference to the Swiss Federal Railways and their rolling stock. (25 pages, illustrated.)

Journal, The Permanent Way Institution. (London.)

1952 **625** .143.1 (42)
Journal, The Permanent Way Institution, Vol. 70, December, p. 153.
LOACH (J.C.). — **Contributions of research in modern rail design.** (2 900 words & figs.)

The Locomotive. (London.)

1953 **621** .438
The Locomotive, January, p. 1.
Gas turbine locomotives. (2 000 words).

1953 **621** .132.1 (42)
The Locomotive, January, p. 11.
B. R. standard class « 4 », 2-6-0 loco. (1 400 words & figs.)

1953 **621** .132.1 (42)
The Locomotive, February, p. 16.
British Railways 2-6-0 Class « 2 » locomotives. (1 200 words & figs.)

Modern Transport. (London.)

1952 **625** .212 (42)
Modern Transport, December 13, p. 15.
Railway wheel making (1 200 words & figs,)

1952 **625** .28 (42)
Modern Transport, December 20, p. 3.
New design of high-speed railway. (1 200 words & figs.)

1952 **625** .162 (42)
Modern Transport, December 20, p. 5.
Electric operation of crossing barriers. (500 words & figs.)

1952 **625** .4 (485)
Modern Transport, December 27, p. 7.
Progress of Stockholm Underground. III. *(Concluded.)* (1 200 words & figs.)

1952 **621** .132.1 (42)
Modern Transport, December 27, p. 13.
Seventh class of standard locomotives. (1 600 words & figs.)

1953 **621** .132.3 (73)
Modern Transport, January 3, p. 6.
POULTNEY (E.C.). — **Norfolk and Western steam power.** (600 words & figs.)

1953 **625** .23 (42)
Modern Transport, January 3, p. 13; January 31, p. 10.
Modern railway carriages : 17) L.S.W.R. steam railmotors; 18) First G.W.R. railmotors. (1 900 words & figs.)

1953 **621** .132.1 (42)
Modern Transport, January 10, p. 6.
British goods engines. Passing of the 0-6-0 as universal type. (400 words & figs.)

1953 **621** .431.72 (44
Modern Transport, January 10, p. 10.
Railcars in France. (900 words & figs.)

1953 **656**
Modern Transport, January 17, p. 3; January 24, p. 10
ARMAND (L.). — **Fundamental techniques in transport.** (3 500 words & figs.)

Proceedings of the Institution of Civil Engineers (London.)

1953 **625** .
Proceedings, The Institution of Civil Engineers, Vol. 2 February, No. 1, p. 106.
CANTRELL (A.H.). — Some major problems i **railway civil engineering maintenance.** (38 pages, illustrated.)

Railway Age. (New York.)

1952 **621** .431.72 (7
Railway Age, November 24, p. 41.
The « Train Master », new locomotive packs 2 40 horsepower. (2 400 words & figs.)

1953 **656** .254 (7
Railway Age, November 24, p. 45.
On the Atlantic Coast Line... — **C.T.C. adapted t volume of traffic** — present and future. (1 100 wor & figs.)

1952 **621** .438 (7
Railway Age, November 24, p. 54.
The gas turbine as railroad motive power. (1 000 wor & fig.)

1952 **625** .244 (7
Railway Age, December 1, p. 93.
From pressed steel car... ART get **500 new-reefer** (1 200 words & figs.)

1952 **625** .232 (7
Railway Age, December 8, p. 68.
Milwaukee gets first **full-length dome-lounge car** (4 800 words & figs.)

The Railway Gazette. (London.)

1953 **625** .232 (6
The Railway Gazette, January 2, p. 13.
Air-conditioned rolling-stock for Egypt. (2 800 wor & figs.)

1953 — 621 .132.1 (42)
The Railway Gazette, January 2, p. 17.
British Railways 2-6-0 Standard class « 4 » locomotives. (1 000 words & figs.)

1953 — 621 .33 (6)
The Railway Gazette, January 9, p. 38.
Increasing the capacity of a Belgian Congo railway. (1 200 words & map.)

1953 — 621 .39 (494) & 624 (494)
The Railway Gazette, January 9, p. 40.
Modern bridging practice in Switzerland. (1 400 words & figs.)

1953 — 621 .132.1 (54)
The Railway Gazette, January 9, p. 44.
Broad-gauge locomotives for India. (400 words & figs.)

1953 — 625 .232 (42)
The Railway Gazette, January 16, p. 68.
BARROW (T.W.). — **Aluminium alloy coaches.** (1 600 words & figs.)

1953 — 621 .3 (42)
The Railway Gazette, January 23, p. 94.
PRIGMORE (B.J.). — **Light-load electrification.** (1 400 words & figs.)

1953 — 385 (071.3 (42) & 621 .33 (42)
The Railway Gazette, January 23, p. 96.
Training motormen for main-line electrification. (1 200 words & figs.)

1953 — 624 .63 (42)
The Railway Gazette, January 30, p. 124.
Prestressed concrete bridge on steelworks railway. (2 000 words & figs.)

1953 — 625 .232 (44)
The Railway Gazette, February, 6 p. 152.
French National Railways stainless steel coaches. (1 500 words & figs.)

Diesel Railway Traction. (London.)

1953 — 621 .431.72 (942)
Diesel Railway Traction, February, p. 27.
Diesel car development in South Australia. (1 900 words & figs.)

1953 — 621 431.72
Diesel Railway Traction, February, p. 31.
A railbus horizontal engine. (800 words & figs.)

1953 — 621 .438
Diesel Railway Traction, February, p. 33.
Gas turbine locomotive possibilities. (3 600 words & figs.)

1953 — 621 .431.72 (495)
Diesel Railway Traction, February, p. 41.
OREFICE (F.S.). — **Metre-gauge railcars for Greece.** (5 000 words & figs.)

Railway Locomotives and Cars. (New York.)

1953 — 621 .431.72
Railway Locomotives and Cars, January, p. 58.
Crankcase explosions... (1 700 words & figs.)

The Railway Magazine. (London.)

1953 — 621 .132.1 (42)
The Railway Magazine, February, p. 108.
British Railways standard class « 4 », 2-6-0 locomotives. (1 200 words & figs.)

Railway Steel Topics. (Sheffield.)

1953 — 625 .141 (42)
Railway Steel Topics, Vol. 1, No. 4, p. 5.
BENNETT (C.R.). — The production of **slag ballast.** (2 000 words & figs.)

1953 — 625 .143.2 (42)
Railway Steel Topics, Vol. 1, No. 4, p. 10.
ALLEN (CECIL J.). — The quest for **increased rail life.** (7 000 words & tables.)

Railway Track and Structures. (Chicago.)

1953 — 625 .142.4 (44)
Railway Track and Structures, February, p. 144.
French Railways try out **concrete sleepers under welded rails.** (600 words & figs.)

1953 — 625 .13 (73)
Railway Track and Structures, February, p. 146.
Act of Congress needed to... **raise south shore bridge 6 ft.** (1 800 words & figs.)

The Overseas Engineer. (London.)

1953 — 625 .212 (42)
The Overseas Engineer, February, p. 224.
Mass produced rail wheels. (2 000 words & figs.)

World Construction. (Chicago.)

1953 — 624 .63 (43)
World Construction, January-February, p. 54.
GOERNER (E.W.). — **Long-span prestressed concrete bridge.** (600 words & figs.)

In Spanish.

Boletin de la Asociación permanente del Congreso Panamericano de Ferrocarriles. (Buenos-Aires.)

1952 — 385 (82)
Boletin de la Asoc. perman. del Congreso Panameric. de Ferrocarriles, noviembre-diciembre, p. 19.
El segundo plan quinquenal en los transportes, 1953-57 (Argentina). (2 000 palabras & fig.)

1952 — 625 .142.2 (460)
Boletin de la Asoc. perman. del Congreso Panameric. de Ferrocarriles, noviembre-diciembre, p. 59.
TERAN Y GALINDO (A.). — Estado actual de los estudios sobre la **conservación de la madera y en especial de las traviesas de ferrocarril.** (2 500 palabras & fig.)

Ferrocarriles y Tranvias. (Madrid.)

1952 **621** .431.72
Ferrocarriles y Tranvias, diciembre, p. 436.
El costo de la tracción Diesel. (300 palabras.)

1952 **621** .133.1
Ferrocarriles y Tranvias, diciembre, p. 437.
COSTILLA (B.). — **Sigamos con las divagaciones.** (1 500 palabras & fig.)

1953 **385** (3)
Ferrocarriles y Tranvias, enero, p. 3.
SECARN. — El **año ferroviario 1952,** a través de la prensa nacional y extranjera. (5 000 palabras.)

1953 **625** .28 (460)
Ferrocarriles y Tranvias, enero, p. 16.
SIEGRIST SPINEDY (E.). — El Plan General de Reconstrucción de la Renfe y la **tracción Diesel.** (2 000 palabras & fig.)

In Italian.

Giornale del Genio Civile. (Roma.)

1952 **721** .1
Giornale del Genio Civile, novembre, p. 623.
PRIOLO (D.). — Il **contributo del terreno laterale alla resistenza delle fondazioni.** (1 500 parole & fig.)

1952 **691**
Giornale del Genio Civile, dicembre, p. 700.
LEVI (F.). — Il problema della **sicurezza nelle opere in cemento armato precompresso.** (6 000 parole.)

1952 **624** .2
Giornale del Genio Civile, dicembre, p. 722.
CONTRI (L.). — Il **metodo di Cross accelerato.** Nota IV. (1 200 parole & fig.)

Ingegneria ferroviaria. (Roma.)

1952 **625** .2 : **625** .62 (45)
Ingegneria ferroviaria, dicembre, p. 855.
PATRASSI (A.). — L'impiego delle **vetture tramviarie articolate** sulla « Circolare Esterna » di Roma. (4 000 parole & fig.)

1952 **621** .431.72 (45)
Ingegneria ferroviaria, dicembre, p. 871.
ZAQUINI (G.). — **Venti mesi di servizio con automotrici** « **Breda** ». (2 000 parole & fig.)

1952 **656** .2
Ingegneria ferroviaria, dicembre, p. 875.
SANTORO (F.). — La produzione base ed aggiuntiva come fondamento della **politica concessionale delle ferrovie.** (2 500 parole.)

Politica dei Trasporti. (Roma.)

1952 **659**
Politica dei Trasporti, dicembre, p. 514.
ROBERT (G.). — **Le relazioni sociali nelle aziende ferroviarie.** (3 500 parole & fig.)

1952 **625** .162 & **656** .25
Politica dei Trasporti, dicembre, p. 523.
SAIJA (L.). — Il **problema dei passaggi a livello** e l
soluzioni offerte dalla moderna tecnica del signalamento
(5 000 parole & fig.)

1952 **621** .431.7
Politica dei Trasporti, dicembre, p. 544.
Costo della trazione Diesel. (600 parole.)

1953 **38**
Politica dei Trasporti, gennaio, p. 16.
PATRASSI (A.). — Ancora sulla scelta e sul **coordinamento dei mezzi di trasporto urbano.** (4 000 parole.

1953 **656** .
Politica dei Trasporti, gennaio, p. 21.
MONTESI (M.). — **Turismo e trasporti.** (3 000 parol
& fig.)

In Netherlands.

De Ingenieur. ('s-Gravenhage.)

1953 **69**
De Ingenieur, nr 3, 16 Januari, p. Bt. 4.
BAKKER (J.A.). — **Beton,** verleden, heden en toekomst. (4 000 woorden.)

1953 **624** (0
De Ingenieur, nr 9, 27 Februari, p. A. 99.
Association Internationale des Ponts et Charpentes
Conclusies van het 4e Congres te Cambridge en Londen
(1 200 woorden.)

1953 **624** .2 & **69**
De Ingenieur, nr 9, 27 Februari, p. Bt. 17.
MAGNEL (G.). — De **berekening van de breukbelastin**
van een voorgespannen beton ligger. (2 000 woorde
& fig.)

Spoor- en Tramwegen. (Utrecht.)

1953 **625** .151 (492
Spoor- en Tramwegen, nr 2, 22 Januari, p. 17.
DEENIK (J.F.). — Een **nieuwe kruising** Blauwkapel
(1 200 woorden & fig.)

1953 **625** .2
Spoor- en Tramwegen, nr 3, 5 Februari, p. 33; nr 4
19 Februari, p. 53; nr 5, 5 Maart, p. 71.
DOUWES DEKKER (C.E.). — Algemeene beschouwingen en toelichtingen over **electrische en dieselelektrische tractie.** (7 000 woorden & fig.)

1953 **625** .28 (489
Spoor- en Tramwegen, nr 3, 5 Februari, p. 42; nr 4
19 Februari, p. 64.
DE HERDER (H.). — De spoorwegen in Denemarke
en de **ontwikkeling der motortractie.** (4 000 woorde
& fig.)

1953 **625** .142.4 (44
Spoor- en Tramwegen, nr 4, 19 Februari, p. 59.
KRABBENDAM (G.). — De **betonnen langsligge**
der SNCF systeem « Laval ». (800 woorden & fig.

M. Weissenbruch & Co., Ltd., Printer to the King, 49, rue du Poinçon, Bruxelles.

MONTHLY BIBLIOGRAPHY OF RAILWAYS(1)

PUBLISHED UNDER THE SUPERVISION OF

P. GHILAIN,

General Secretary of the Permanent Commission of the International Railway Congress Association.

(JUNE 1953)

[**016.** 385. (02]

I. — BOOKS.

In French.

1953 385 (08 (493)

OMPAGNIE BELGE DE CHEMINS DE FER ET D'ENTREPRISES.

Rapports à l'assemblée générale ordinaire du 11 mars 53. **Exercice 1952,** 72e exercice social.

Bruxelles, édité par la Compagnie ci-dessus, 33, rue l'Industrie. Une brochure (22.5 × 29.5 cm) de pages.

1953 62 (01

Contrôle non destructif des matériaux.

Düsseldorf, *Verlag Stahleisen* et Saint-Germain-en-ye (S. & O.), *Editions Métaux*, 32, rue du Maréchal ffre. Un volume (21 × 27 cm) de VIII-166 pages, ec de nombreuses illustrations. (Prix : broché, 1 500 fr.)

1952 621 .3 (02

ENIS-PAPIN (M.).

Aide-Mémoire Dunod « Electrotechnique Générale », 52.

Paris, Dunod, éditeur. Un volume (10 × 15 cm) de 26 pages, avec 242 figures. (Prix : 450 fr. fr.)

1953 624 .2

IOMBACH (R.).

Abaques et tables pour le calcul des poutres continues travées inégales.

Paris, Librairie Eyrolles. Un volume (21 × 27 cm) de 4 pages, avec 32 abaques et 25 tables. (Prix : 2 700 fr.)

1953 385 (73)

RGANISATION EUROPÉENNE DE COOPÉRATION ÉCONOMIQUE (O.E.C.E.).

Les Chemins de fer aux U. S. A. Rapport d'un groupe experts européens.

Publié par l'O.E.C.E. En vente aux Presses Universiires de France, 108, boulevard Saint-Germain et chez urs agents. (Prix : 1 750 fr. fr.)

In German.

1952 621 .3

OBERDORFER (G.).

Kurzes Lehrbuch der Elektrotechnik.

Wien, Springer-Verlag. 199 Seiten mit 231 Abbildungen. (Preis : D M. 14.40; Ganzleinen D.M. 16.80.)

1953 62 (02

Uhlands Ingenieur-Kalender 1953. 70. Jahrgang, herausgegeben von Dr. Ing. W. SCHUMACHER.

Stuttgart, Alfred Kröner Verlag. 1 Band mit 360 Abbildungen, XVI und 577 Seiten. (Preis : Ganzleinen, D.M. 16.—.)

In English.

1953 691 & 721 .9

ABELES (P.W.).

Principles and practice of prestressed concrete. *Vol. I, Second edition.*

One volume of 116 pages (10 × 7 1/2 in.). Publishers: Crosley Lockwood and Son, Ltd., 39, Thurloe Street, London S.W. 7. (Price: 21 s.)

1953 385 (061 .4 (73)

American Railway Engineering Association Bulletin, January, Vol. 54. No. 506.

Reports of Committees:

Records and Accounts. — Cooperative relations with Universities. — Iron and steel structures. — Wood bridges and trestles.

One brochure of 125 pages, published by the American Railway Engineering Association, 59, Van Buren Street, Chicago 5, Ill.

---

(1) The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress njointly with the Office Bibliographique International, of Brussels, (See « Bibliographical Decimal Classification as applied to Railway ience », by L. WEISSENBRUCH, in the number for November 1897, of the *Bulletin of the International Railway Congress*, p. 1509.)

1953 **385** (061.4 (73)

American Railway Engineering Association Bulletin, Vol. 54, No. 507. February.

Reports of Committees:

Track. — Roadway and ballast. — Continuous welded rail. — Rail.

One volume of 295 pages, illustrated, published by the American Railway Engineering Association, 49, East Van Buren Street, Chicago, Ill. (Subscription: 10 $ per annum.)

1952 **385** (061.4 (73) & **656** .25 (73)

Association of American Railroads. Signal Section. Advance Notice. Vol. XLIX, No. 1.

Reports to be presented at the Fifty-fourth annual meeting. Quebec, Que., Canada. September 29, 30 and October 1, 1952.

Office of the Secretary, 59, East Van Buren Street, Chicago 5, Ill.

1953 **621** .3

DRYSDALE (C.V.) and JOLLEY (A.C.).

Electrical measuring instruments. *Part I. General principles and electrical indicating instruments.* Second edition, revised by Dr. G.F. Tagg.

London : Chapman and Hall, Limited, 37, Essex Street, Strand, W.C. 2. (Price : 75 s. net.)

1953 **385** (09 (42)

DUNN (J.M.)

The Stratford upon - Avon and Midland Junction Railway.

The Oakwood Press, Tanglewood, South Godstone, Surrey. (Price: 5 s. net.)

1953 **669**

EDWARDS (C.A.)

The structure and properties of mild steel. Publishe by J. Garnet Miller, Limited, and distributed by Qualit Press, Limited, Bouverie House, 154, Fleet Stree London E.C. 4. (Price: 20 s. net.)

1953 **31** & 6

HALD (A.).

Statistical theory with engineering applications.

London : Chapman and Hall, 37, Essex Street, W.C. (Price: 72 s.)

1952 **625** .143 (7

University of Illinois Bulletin. Reprint Series No. 4

CRAMER (E.) and JENSEN (R.S.).

Progress reports on investigation of railroad rails an joint bars.

One brochure of 36 pages, illustrated, published b the University of Illinois, 358, Administration Building Urbana, Illinois. (Price: thirty cents.)

In Netherlands.

1952 **624** .

VAN TUSSENBROEK (P.J.) en MIJLING (F.H.

De rekenmethode Cross voor de beton- en staalconstruc ties.

Amsterdam, N.V. Uitgeverij « Argus ». 275 blac zijden met 315 figuren en 142 tabellen. (Prijs : 22.50 gu den.)

[**016.** 385. (05]

II. — PERIODICALS.

In French.

Annales des ponts et chaussées. (Paris.)

1953 **624** .52 (44)

Annales des Ponts et Chaussées, janvier-février, p. 9.

BONNET (M.). — Le **nouveau pont de Villeneuve-Saint-Georges.** (5 000 mots, tableaux & fig.)

1953 **721** .1

Annales des Ponts et Chaussées, janvier-février, p. 49.

BONTRON (J.). — La **stabilité des massifs de fondation** sous l'action de forces horizontales. (1 200 mots.)

Bulletin scientifique de l'Association des Ingénieurs électriciens sortis de l'Institut Électrotechnique Montefiore. (Liège.)

1952 **621** .32

Bulletin scient. de l'Assoc. des Ing. électr. sortis de l'Institut Electrotech. Montefiore, décembre, p. 1257.

THESIO (H.). — Les **lampes à fluorescence** et leurs appareillages de stabilisation. Relèvement du facteur de puissance. (7 000 mots & fig.)

Bulletin de la Société des Ingénieurs Civils de France (Paris).

1952 **621** .3

Bull. de la Soc. des Ing. civils de France, n° 23, p. 26

ARMAND (L.). — Autour des **techniques nouvelle de l'électrification des chemins de fer.** *(Résumé.)* (1 00 mots.)

L'Industrie des Voies ferrées et des Transports automobiles. (Paris.)

1953 **625** .3 (44

L'Industrie des Voies ferr. et des Transp. automobiles janvier, p. 3.

HUG (Ad.-M.). — Modèle de **monorail de type nou veau** en Allemagne occidentale. (1 500 mots & fig.)

1953 **625** .61

L'Industrie des Voies ferr. et des Transp. automobiles janvier, p. 6.

RIPERT (L.). — L'application des **méthodes moderne d'entretien des voies** dans les chemins de fer secondaire (2 200 mots & fig.)

1953 **656** .254 (44)

'Industrie des Voies ferr. et des Transp. automobiles, février, p. 23.

BIBARD (R.L.). — **Banalisation des voies et commande ntralisée de la circulation** S.N.C.F. entre Blaisy-Bas Dijon. (2 100 mots & fig.)

Rail et Route. (Paris.)

1953 **625** .1 (44)

ail et Route, janvier, p. 3.

FRANCOU (M.). — Le **déplacement des voies ferrées** ans la traversée de la ville de Nantes. (1 500 mots fig.)

1953 **621** .431.72 (460)

ail et Route, février, p. 12.

HAMACHER HENSE (W.). — **L'exploitation d'auto-ils et de trains automoteurs** sur le réseau des Chemins fer espagnols. (1 500 mots & fig.)

1953 **625** .3 (494)

ail et Route, mars, p. 14.

Histoire et développement du **chemin de fer de la ngfrau.** (1 500 mots & fig.)

Rail et Traction. (Bruxelles.)

1952-1953 **625** .1 (493)

ail et Traction, octobre-janvier, p. 3.

GUILLAUME (H.F.). — La **Jonction Nord-Midi** t en service. (4 000 mots, tableaux & fig.)

1953 **621** .33 (675)

ail et Traction, février-mars, p. 3.

L'électrification du premier tronçon du Chemin de r du Bas-Congo-Katanga. (2 500 mots & fig.)

Revue de l'Association française des Amis des Chemins de fer. (Paris.)

1953 **625** .23 (44)

evue de l'Association franç. des Amis des Ch. de fer, janvier-février, p. 1.

HAFFNER. — La **métallisation des voitures** à la égion Ouest de la S.N.C.F. (3 000 mots & fig.)

1953 **621** .132.8 (42) & **621** .438 (42)

evue de l'Association franç. des Amis des Ch. de fer, janvier-février, p. 9.

LE MAZURIER. — La **locomotive à turbine à gaz** ° **18100** construite par la « Metropolitan Vickers » our les Chemins de fer Britanniques. (2 500 mots & fig.)

1953 **625** .24 (44)

evue de l'Association franç. des Amis des Ch. de fer, janvier-février, p. 16.

BRUHAT (L.). — La **métallisation des fourgons G.V.** e la S.N.C.F. (2 200 mots & fig.)

Revue Générale des Chemins de fer. (Paris.)

1953 **621** .133.1

Revue générale des Chemins de fer, février, p. 53.

RIBOUD (J.M.). — **Le pétrole et le chemin de fer.** (5 000 mots & fig.)

1953 **656** .257 (44)

Revue générale des Chemins de fer, février, p. 67.

TISNÈS et RICHARD. — La **nouvelle signalisation** de la Grande Ceinture de Paris. (5 500 mots & fig.)

1953 **621** .431.72 (44)

Revue générale des Chemins de fer, février, p. 81.

BIROLAUD et VALLANTIN. — Le **nouveau centre d'autorails** de Lyon-Vaise. (4 000 mots & fig.)

1953 **656** .212.5 (44)

Revue générale des Chemins de fer, février, p. 90.

BASQUIN et VATRY. — La **réduction du nombre des triages secondaires** sur la Région du Nord de la S.N.C.F. (4 000 mots & fig.)

1953 **656** .222 (44)

Revue générale des Chemins de fer, février, p. 101.

La **régularité de la circulation** sur la S.N.C.F. en 1952. (500 mots & tableaux.)

Revue générale de Mécanique. (Paris.)

1952 **625** .245 (44) & **669** .71 (44)

Revue générale de Mécanique, octobre, p. 308.

Wagons-trémies en alliages d'aluminium. (500 mots & fig.)

1952 **621** .9 (06 (4)

Revue générale de Mécanique, décembre, p. 361.

CHALVET (M). — La deuxième **Exposition Européenne de la Machine-outil.** (10 000 mots, tableaux & fig.)

Science et Technique. (Bruxelles.)

1952 **624** .2

Science et Technique, n° 7/8, p. 131.

FRICERO (E.). — Le problème de la **poutre encastrée** dans un mur et, d'une façon plus générale, d'une tige encastrée dans un massif. (1 500 mots & fig.)

1952 **621** .33 (493)

Science et Technique, n° 9/10, p. 160.

MAHIELS (J.). — **L'évolution des méthodes d'exploitation des réseaux de chemin de fer** et leurs possibilités nouvelles. (2 000 mots & fig.)

La Technique Moderne. (Paris.)

1952/53 **621** .138.5 (44)

La Technique Moderne, décembre, p. 353; février, p. 33.

DELON (A.). — La **réduction des dépenses d'entretien des engins de traction** à la S.N.C.F. par les améliorations constructives et la rationalisation de la réparation (6 000 mots & fig.)

1953 **621** .132.8 (44) & **621** .438 (44)
La Technique Moderne, janvier, p. 11.
La **locomotive à générateur à pistons libres et à turbine à gaz.** (1 500 mots & fig.)

Trains. (Bruxelles.)

1952 **621** .33 (493) & **625** .1 (493)
Trains, nº 11-12, p. 1 à 44.
La **Jonction Nord-Midi.** (Inauguration et articles connexes de description de la Jonction). (12 000 mots & fig.)

1952 **621** .33 (493) & **625** .1 (493)
Trains, nº 11-12, p. 45.
DEGREEF (V.) et SOETE (A.). — La **réalisation du gabarit de la section libre pour la traction électrique** sur le tronçon Bruxelles-Gand. (1 500 mots & fig.)

1952 **725** .31 (493)
Trains, nº 11-12, p. 55.
DELMOTTE (F.). — La reconstruction du **bâtiment des recettes** de la gare de Mons. (1 500 mots & fig.)

1952 **625** .1 (493)
Trains, nº 11-12, p. 61.
JACOPS (A.). — Les **plans inclinés** de Liège. (1 600 mots & fig.)

Travaux. (Paris.)

1952/1953 **624** (44) & **691** (44)
Travaux, décembre, p. 544; janvier, p. 35.
BRUYANT (J.) et HEMARD (M.). — Construction d'un **pont en béton précontraint** à Beauvais. (3 500 mots & fig.)

1952 **624** .6
Travaux, décembre, p. 567.
LAYRANGUES (P.). — **Calcul d'un arc encastré symétrique** à appuis de niveau sous l'effet d'un vent horizontal. (3 000 mots & fig.)

La Vie du Rail. (Paris.)

1953 **621** .335 (44)
La Vie du Rail, 2 février, p. 3.
Les **locomotives BB 9003-9004 à grande vitesse.** (1 000 mots & fig.)

1953 **625** .232 (42)
La Vie du Rail, 2 février, p. 5.
Voitures-camping en Grande-Bretagne. (100 mots & fig.)

1953 **625** .13 (44)
La Vie du Rail, 9 février, p. 3.
LE CALVEZ (R.). — **Travaux sous le tunnel de Rouen.** (1 200 mots & fig.)

1953 **656** .222.5 (44)
La Vie du Rail, 9 février, p. 8.
POUY (H.). — **Organisation des trains de pèlerinages** sur la Région du Sud-Ouest de la S.N.C.F. (1 200 mots & fig.)

In German.

Der Eisenbahningenieur. (Frankfurt a. Main.)

1953 **625** .143.
Der Eisenbahningenieur, Februar, S. 28.
STEINWEDE (A.). — Einiges über die **Entwicklung de Oberbaues.** — Schwerere Schienen mit breiterem Fus und einfachere Schienenbefestigung auf den zunehmen verwendeten Hartholzschwellen im In- und Auslan (1 200 Wörter & Abb.)

1953 **625** .15
Der Eisenbahningenieur, Februar, S. 30.
WIEDER (H.). — Was ist beim Einbau vo **Drehscheiben** zu beachten? (1 000 Wörter & Abb.)

1953 **625** .25
Der Eisenbahningenieur, Februar, S. 34.
RÖHLING (F.). — Das **Problem der Laufzielbremsun im Ablaufbetrieb.** (4 000 Wörter & Abb.)

E.T.R. Eisenbahntechnische Rundschau. (Köln-Darmstadt.)

1953 **625** .142.
Eisenbahntechnische Rundschau, Februar, S. 47.
GNEIST (A.). — Ein Beitrag zur Bestimmung de **Lebensdauer von Holzschwellen.** (1 500 Wörter & Abb.

1953 **625** .285 (43
Eisenbahntechnische Rundschau, Februar, S. 51.
GAEBLER (G.-A.). — Zukünftige Wege der **Fahrzeugentwicklung** unter besonderer Berücksichtigung de **Brennkraftschienenfahrzeuge.** (6 000 Wörter, Tabelle & Abb.)

1953 **625** .14
Eisenbahntechnische Rundschau, Februar, S. 76.
SCHRAMM (G.). — **Neuere Entwicklungen im Oberbau** Eine erweiterte Buchbesprechung des Buches « Eisenbahnoberbau » von HANKER. (2 000 Wörter & Abb.

Elektrische Bahnen. (München.)

1953 **621** .33
Elektrische Bahnen, Januar, S. 1.
KLOSS (G.). — Verzweigungsmechanismen al **Antriebselemente elektrischer Triebfahrzeuge.** (5 000 Wörter & Abb.)

1953 **621** .335 (43
Elektrische Bahnen, Januar, S. 14.
CRUSIUS (K.). — Eine **versetzbare und selbsttätige Ladeanlage für Akkumulatoren-Triebwagen.** (1 200 Wörte & Abb.)

1953 **621** .33
Elektrische Bahnen, Januar, S. 17.
KERBER (A.). — **Erfahrungen mit elektrische Wechselstrom-Fahrmotoren** (aus dem Betrieb). (1 20 Wörter & Abb.)

1953 **621** .33 (436)
Elektrische Bahnen, Januar, S. 22.
KOCI (A.). — Die **Elektrisierung** der Österreichische Bundesbahnen im Jahre 1952. (500 Wörter & Abb.)

Glasers Annalen. (Berlin.)

1953 **625** .232 (94)
asers Annalen, Januar, S. 1.
BODE (F.). — **Spezialreisezüge** für Australien. (1 200 örter & Abb.)

1953 **625** .232 (43)
asers Annalen, Januar, S. 4.
RENAUD (W.). — Die **Entwicklung** des **Speise-gen-, Schlafwagen-** und **Wirtschaftswagenbetriebes** ch 1945 in der Bundesrepublik Deutschlands. (1 500 örter & Abb.)

1953 **625** .235
asers Annalen, Januar, S. 9.
SCHMÜCKER (B.). — **Wirtschaftliche Anstrischstoffe** r Güterwagenhölzer. (3 000 Wörter & Abb.)

1953 **625** .245 (43)
asers Annalen, Januar, S. 14.
BARTSCH (H.) & SCHRÖDER (H.-H.). — Der **lbstentladewagen** der Marburger Kreisbahn. (1 000 örter & Abb.)

1953 **656** .222.5
asers Annalen, Januar, S. 16; Februar, S. 36.
Prof. Dr.-Ing. e.h. NORDMANN (H.). — Beiträge r Geschichte des **Fahrplanwesens.** (10 000 Wörter.)

Internationales Archiv für Verkehrswesen. (Mainz.)

1953 **625** .11
t. Archiv. für Verkehrswesen, Nr. 1, 1. Januarheft, S. 1.
Prof. Dr.-Ing. MÜLLER (W.). — Über das **Trassieren** r **Eisenbahnen und der Autobahnen.** (5 000 Wörter Bild.)

1953 **625** .173 (43)
t. Archiv. für Verkehrswesen, Nr. 1, 1 Januarheft, S. 10.
Die **Bauaufgaben** der Deutschen Bundesbahn. (1 000 örter.)

1953 **656**
t. Archiv. für Verkehrswesen, Nr. 2, 2. Januarheft, S. 25.
PIRATH (C.). — Das **Ausgleichsprinzip im Verkehrs-sen.** (6 000 Wörter.)

1953 **625** .3 (43)
t. Archiv für Verkehrswesen, Nr. 2, 2. Januarheft, S. 32.
RYBACK (A.). — **Konstruktion** und **Bedeutung der ALWEG »-Bahn.** (2 000 Wörter & Abb.)

1953 **656** .225 & **656** .261
t. Archiv für Verkehrswesen, Nr. 3, 1. Februarheft, S. 54.
Prof. Dr. BÄSELER. — Die **Umgestaltung der Eisen-hn durch den Behälter.** (5 000 Wörter.)

1953 **388** (73)
t. Archiv für Verkehrswesen, Nr. 3, 1. Februarheft, S. 62.
COLBERG (Dr. R.). — Vom **New Yorker Schnell-hnnetz.** (1 000 Wörter & Karte.)

Signal und Draht. (Frankfurt a. Main.)

1953 **656** .25 (43)
Signal und Draht, Januar, S. 9.
SCHMITZ (W.). — 1952-1953. **Signal- und Fernmeldeanlagen erhöhen die Betriebsleistungen und die Wirtschaftlichkeit.** (2 500 Wörter & Abb.)

1953 **656** .256.3
Signal und Draht, Januar, S. 13.
HOFMANN (F.). — Induktionsgeschützte **Wechselstrom- Blockschaltungen** mit Erdschlussprüfung. (1 000 Wörter & Abb.)

1953 **656** .259
Signal und Draht, Februar, S. 26.
RÖHR (W.). — Ein **neuartiger Verbinder für isolierte Gleise.** (1 200 Wörter & Abb.)

1953 **656** .212.5 (73)
Signal und Draht, Februar, S. 32.
WOLF (O.). — **Neuartige Ablaufanlage** des Rangierbahnhofes Milwaukee-Air-Line (U.S.A.). (1 000 Wörter & Abb.)

In English.

The Engineer. (London.)

1953 **621** .33 (42)
The Engineer, March 6, p. 352.
Installation of long conductor rails on the Southern Region. (1 100 words & figs.)

1953 **621** 438 (44)
The Engineer, March 6, p. 358.
The Renault gas turbine locomotive. (3 000 words & figs.)

1953 **656** .212.6 (42)
The Engineer, March, 13, p. 385.
A wagon tippler. (1 200 words & fig.)

1953 **625** .26 (42)
The Engineer, March 13, p. 395.
Carriage shed at Willesden. (2 400 words & figs.)

Engineering. (London.)

1953 **621** .132.1 (42)
Engineering, February 13, p. 217.
Standard Class-2, 2-6-0 locomotives. British Railways. (1 200 words & figs.)

1953 **625** .24 (42) & **625** .617 (42)
Engineering, February 13, p. 221.
Wagons and containers of British Railways. (1 500 words & tables.)

1953 **621** .33 & **625** .25
Engineering, February 20, p. 244.
WALL (T.F.). — **Electric traction braking** (I.). (1 800 words & figs.)

1953 **621** .438 (42)
Engineering, February 20, p. 247.
DYMOND (A.W.J.). — **Operating experiences with two gas-turbine locomotives** *(to be continued)*. (1 400 words.)

Modern Transport. (London.)

1953 **625** .245 (42)
Modern Transport, January 17, p. 10.
Railway tests of standard pallets. (1 100 words & figs.)

1953 **625** .232 (42)
Modern Transport, January 31, p. 7.
Camping coaches on railways. (500 words & figs.)

1953 **621** .431.72 (42)
Modern Transport, February 7, p. 6.
Diesel railcars. (1 200 words & figs.)

1953 **656** .1 (42) & **656** .2 (42)
Modern Transport, February 7, p. 12.
Transport in Leinster and Ulster. Road and rail facilities of G.N.R. (800 words & figs.)

1953 **656** .2 (68)
Modern Transport, February 14, p. 3.
HECKROODT (W.). — **Transport progress in South Africa** *(to be continued)*. (1 500 words & figs.)

The Oil Engine (London.)

1953 **621** .431.72 (489)
The Oil Engine, February, p. 365.
British locomotives for Danish Railways. (400 words & figs.)

1953 **621** .438 (73)
The Oil Engine, February, p. 375.
Service results with a twin-engined locomotive. (1 600 words & figs.)

1953 **621** .438 (42)
The Oil Engine, March, p. 401.
Service history of Western Region's G.T. locos. (1 400 words of figs.)

Railway Age. (New York.)

1952 **625** .174 (73)
Railway Age, December 8, p. 77.
Economic snow melting **with electric switch-heaters.** (600 words & figs.)

1952 **625** .174 (73)
Railway Age, December 15, p. 56.
WYLIE (L.). — How much horse power? **Snow removal** in mountain districts. (400 words & figs.)

1952 **621** .438 (73)
Railway Age, December 29, p. 44.
What the Union Pacific gas turbines have been doing. (2 300 words & figs.)

1953 **656** .254 (73)
Railway Age, January 5, p. 35.
How railroads are improving yard and terminal operations. (4 000 words & figs.)

1953 **625** .214 (73)
Railway Age, January 5, p. 44.
The case for the solid journal bearing. (3 600 words & figs.)

1953 **625** .236 (7
Railway Age, January 19, p. 34.
Movable car washer does good job. (1 400 wor
& figs.)

1953 **385** (7
Railway Age, January 12, p. 144.
PARMELEE (J.H.). — **A review of railway operatio
in 1952.** (12 000 words, tables & figs.)

1953 **656** .254 (7
Railway Age, January 26, p. 39.
**How the Southern Pacific uses train-wayside radio...
the High Sierra.** (1 900 words & figs.)

1953 **625** .25 (7
Railway Age, January 26, p. 48.
SWAN (J.S.). — **Don't hurry a freight-train sto
(1 600 words & figs.)

1953 **621** .438 (4
Railway Age, February 2, p. 39.
POULTNEY (E.C.). — **British road tests reveal
efficiency of a gas-turbine locomotive.** (2 200 word
tables & figs.)

The Railway Gazette. (London.)

1953 **625** .162 (4
The Railway Gazette, February 6, p. 154.
Lifting barriers in New South Wales. (400 wor
& figs.)

1953 **621** .332 (4
The Railway Gazette, February 6, p. 155.
Tubular steel structures for overhead lines. (1 00
words & figs.)

1953 **621** .133.8 (4
The Railway Gazette, February 6, p. 157.
Speed indicating on locomotives. (1 100 words & figs

1953 **621** .132.1 (4
The Railway Gazette, February 13, p. 184.
**British Railways Class « 2 » standard locomotiv
(800 words & figs.)

1953 **621** .3
The Railway Gazette, February 20, p. 206.
VINCZE (S.A.). — **From timetable to substation
(1 800 words & figs.)

1953 **621** .335 (4
The Railway Gazette, February 20, p. 209.
French National Railways Co-Co locomotives. (1 60
words & figs.)

1953 **621** .132.7 (6
The Railway Gazette, February 20, p. 212.
**Shunting locomotives for the South African Railway
(800 words & figs.)

1953 **625** 143.5 (4
The Railway Gazette, February 27, p. 234.
Flexible rail clip for F.B. track. (600 words & figs

1953 **621** .1
The Railway Gazette, February 27, p. 235.
McARD (Geo. W.). — **Problems of locomotive torqu
(3 000 words & figs.)

Diesel Railway Traction. (London.)

953 **621** 431.72
esel Railway Traction, March, p. 51.
McARD (G.W.). — **Ventilation and air-conditioning Diesel railcars.** (4 800 words & figs.)

953 **621** .431.72
esel Railway Traction, March, p. 60.
The **multi-car Diesel train in Europe.** (9 000 words figs.)

ilway Locomotives and Cars. (New York.)

953 **625** 25 (73)
ilway Locomotives and Cars, February, p. 45.
What causes stresses in brake beams. (1 600 words figs.)

953 **625** 232 (73)
ilway Locomotives and Cars, February, p. 49.
Dome-lounge cars for the Milwaukee. (3 000 words figs.)

953 **625** .214
ilway Locomotives and Cars, February, p. 62.
DICK (J.G.). — **Are solid journal bearings neglected?** 00 words.)

953 **625** .25 (73)
ilway Locomotives and Cars, February, p. 69.
Dynamic braking for low-grade lines. (4 800 words fig.)

The Railway Magazine. (London.)

953 **656** .254 (42)
e Railway Magazine, March, p. 147.
Power signalling at Euston. (2 900 words & figs.)

Railway Engineering and Maintenance. (Chicago.)

952 **625** .174 (73)
ilway Engineering and Maintenance, August, p. 755.
What savings with propane switch heaters? (2 400 rds, tables & figs.)

952 **624** (06 (73) & **625** (06 (73)
lway Engineering and Maintenance, October, p. 979.
Convention report. — Roadmasters' and Maintenance Way Association; American Railway Bridge & Build- Association, September 15-17, 1952. (24 pages, strated.)

In Spanish.

Ferrocarriles y Tranvias. (Madrid.)

953 **385** (09.3 (494)
rocarriles y Tranvias, febrero, p. 41.
IAMACHER (F.W.). — Ejemplo de una buena ion estatal. **Los Ferrocarriles Federales Suizos cumplen uenta años.** (4 000 palabras & fig.)

1953 **625** .25 (460)
Ferrocarriles y Tranvias, febrero, p. 56.
ROMAN (C.). — ¿ Aconsejan nuestros perfiles la adoptión de un **freno inagotable**? (2 500 palabras & fig.)

1953 **625** .23 (460)
Ferrocarriles y Tranvias, febrero, p. 69.
La técnica pesada y la técnica ligera. (500 palabras & cuadros.)

Hormigón elastico. (Buenos Aires.)

1952 **624** .63 (497.1)
Hormigón elastico, nº 11, noviembre, p. 3.
Prof. Dr. M. ROS & Ing. M. R. ROS. — El gran **puente carretero** sobre el Save en Beograd-Zemun, Yugoeslavia. **Construcción de hormigon elastico**, sistema BBRV, y construcción metalica. Estudio comparativo. (1 000 palabras & fig.)

1952 **624** .2 & **691**
Hormigón elastico, nº 11, noviembre, p. 19.
SCIAMMARELLA (C.). — Estudio experimental de **vigas tipo « Zofra »** *(Conclusión)*. (2 500 palabras & fig.)

Revista de Obras Publicas. (Madrid.)

1953 **691**
Revista de Obras publicas, febrero, p. 76.
LOPEZ NIETO (A.). — Nomogramas para el **calculo de secciones rectangulares de hormigon armado.** (2 500 palabras & fig.)

In Italian.

Ingegneria ferroviaria. (Roma.)

1953 **625** .1 (45) & **625** .2 (45)
Ingegneria ferroviaria, gennaio, p. 3.
DI RAIMONDO (G.). — **Sguardo panoramico all' attività delle F. S. nell'anno 1952.** (12 000 parole, tavole & fig.)

1953 **625** .113
Ingegneria ferroviaria, gennaio, p. 31.
POLSONI (G.). — Alcuni aspetti della **correzione** delle curve. (3 500 parole, 1 tabella & fig.)

1953 **621** .33
Ingegneria ferroviaria, gennaio, p. 37.
STAGNI (E.). — Possibilità di **applicazione dei giunti a scorrimento nella trazione monofase a 50 Hz.** (3 500 parole & fig.)

1953 **656** (45)
Ingegneria ferroviaria, gennaio, p. 45.
STABILINI (L.). — **Politica dei trasporti.** (2 000 parole.)

1953 **656** (45)
Ingegneria ferroviaria, gennaio, p. 48.
ORCORTE (A.). — Il **problema del coordinamento strada - rotaia** al Congresso del Sindacato Funzionari delle F. S. (Firenze, 7-9 dicembre 1952). (4 000 parole.)

1953 **531** & **625** .28
Ingegneria ferroviaria, febbraio, p. 91.
DI MAYO (F.). — **Studio analitico del moto vario.** (4 500 parole, tabelle & fig.)

1953 **625** .2
Ingegneria ferroviaria, febbraio, p. 101.
SAVOJA (A.). — **Le spese relative al materiale rotabile.** (2 000 parole.)

1953 **656** .1 (45)
Ingegneria ferroviaria, febbraio, p. 111.
VEZZANI (F.). — **Entità e costo degli autotrasporti** nell' anno 1952. (12 000 parole & tabelle).

Trasporti Pubblici (Roma.)

1952 **621** .332
Trasporti Pubblici, luglio-agosto, p. 797.
GOSSI (A.). — Procedimenti per il **calcolo di stabilità dei sostegni a pali abbinati per linee elettriche.** (5 000 parole, tabelle & fig.)

1952 **625** .42 (45)
Trasporti Pubblici, luglio-agosto, p. 729; settembre, p. 897; ottobre, p. 1019.
PERRONE (V.). — La **Ferrovia Metropolitana a Roma** *(Continuazione)*. (5 500 parole, tavole & fig.)

1952 **385** .57
Trasporti Pubblici, settembre, p. 963.
BELLINI (Dott. A.). — La misura della robustezza nella **selezione professionale.** (2 500 parole & tavole.)

1952 **625** .143.5
Trasporti Pubblici, settembre, p. 971.
TAGLIAFERRO (V.). — **Caratteristiche e vantaggi dell' attacco indiretto** applicato sull' armamento della rete delle Strade Ferrate Secondarie Meridionali (1 500 parole & fig.)

In Netherlands.

De Ingenieur. ('s-Gravenhage.)

1953 **725** .31 (492)
De Ingenieur, 20 Maart, p. B. 53.
SCHELLING (H.G.J.). — **Nieuwere spoorwegstations.** (4 500 woorden, tabellen & fig.)

Spoor- en Tramwegen. (Utrecht.)

1953 **625** .1
Spoor- en Tramwegen, nr 5, 5 Maart, p. 69.
EISSES (J.A.). — Een nieuwe constructie voor **bevloering van overwegen.** (1 000 woorden & fig.)

1953 **656** .212
Spoor- en Tramwegen, nr 5, 5 Maart, p. 74.
v. SCHOOTEN (S.P.). — **Oploopsnelheden** va **wagens.** (800 woorden & fig.)

1953 **385** (09 (4
Spoor en Tramwegen, nr 5, 5 Maart, p. 78; nr 6, 19 Maar p. 96.
VOERMAN (A.A.A.E.A.). — **De Russische Spoo wegen.** (4 000 woorden & kaarten.)

In Portuguese.

Gazeta dos Caminhos de ferro. (Lisboa.)

1953 **62**
Gazeta dos Caminhos de ferro, nº 1561, 1 Janeir p. 389.
ESTEVES (R.). — **Os Caminhos de ferro e a defe anti-aérea.** (1 500 palavras.)

1953 **624** .62 (46
Gazeta dos Caminhos de ferro, nº 1561, 1 Janeir p. 393.
ABRAGÂO (F.). — **A ligacâo de Lisboa com o Port por Caminho de ferro.** (3 500 palavras & fig.)

Técnica. (Lisboa.)

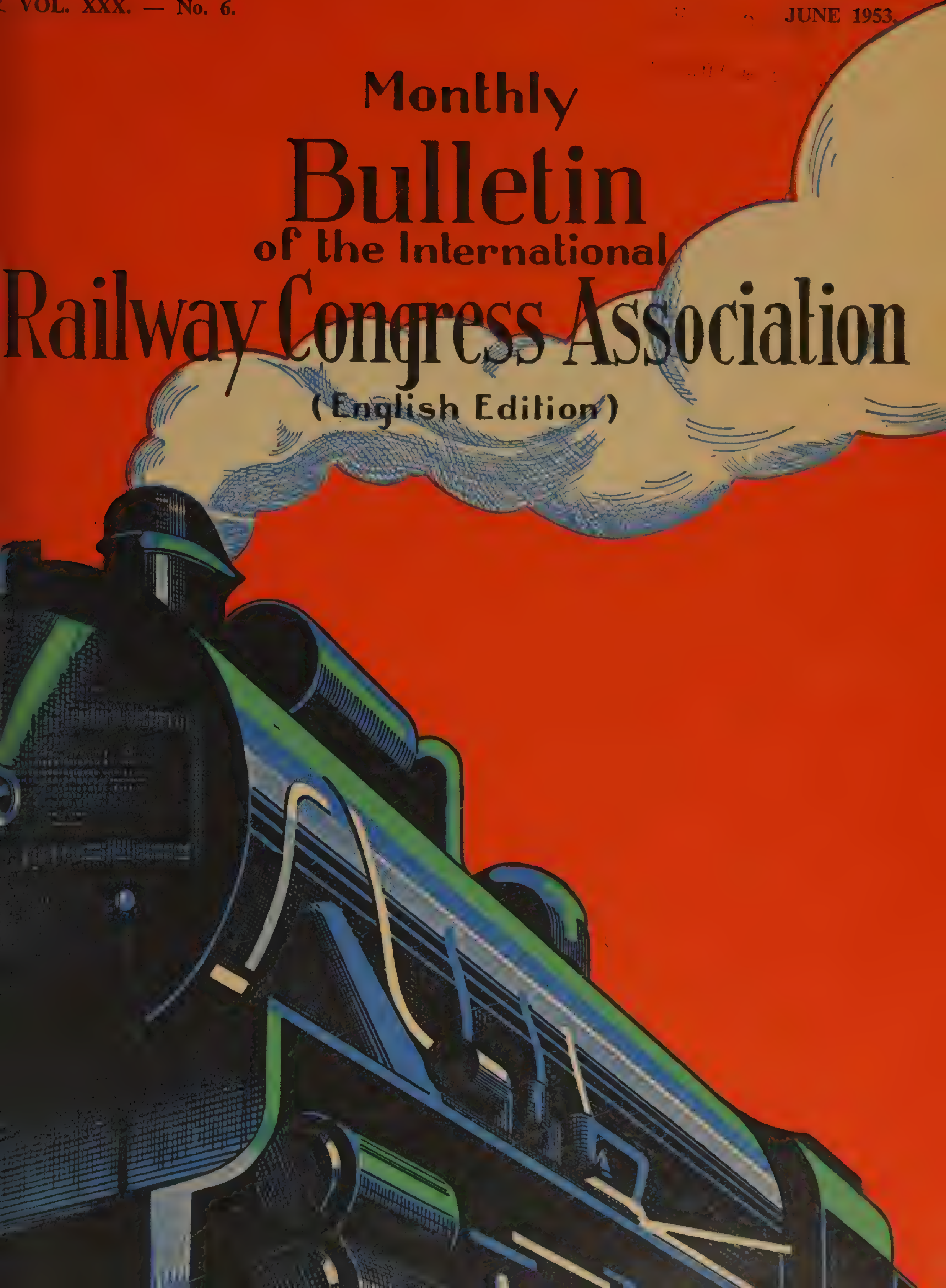
1952 **721** .
Técnica, nº 226, novembro, p. 125.
NASCIMENTO (U.). — Calculo expedito de tensô de segurança e de assentamentos de **fundacôes.** (1 00 palavras & fig.)

M. Weissenbruch & Co., Ltd., Printer to the King, 49, rue du Poinçon, Bruxelles.

VOL. XXX. — No. 6. JUNE 1953.

Monthly Bulletin of the International Railway Congress Association

(English Edition)



London Transport NEW Push Button Signal Control

◆ ◆ ◆

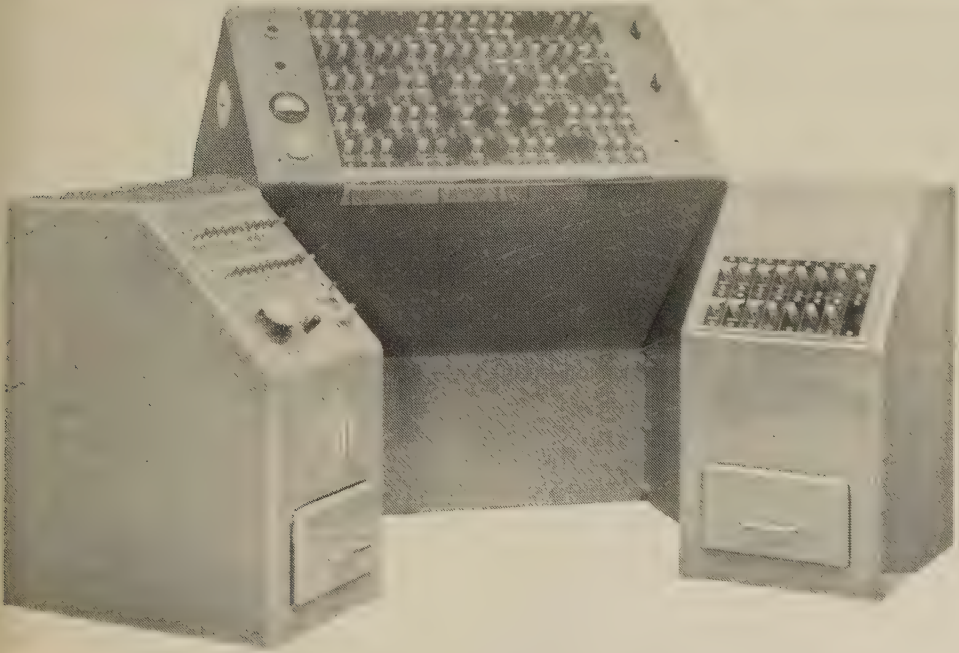
Photo by courtesy of London Transport

This control desk, constructed in our Works to the requirements of Mr. R. Dell, Signal Engineer of London Transport Executive, is now operating the modernised signal system at Ealing Broadway. Fitted with push button control it is operated by one signalman only against the two previously required to work the two older frames. The operation of one push button completes the control of one particular train movement and the button automatically returns to normal position. Pre-selection allows the signalman to operate the button for a route ahead of the movement taking place, the route being automatically set up immediately the preceding movement is completed and the tracks cleared. Mental strain on the signalman is considerably reduced as he can select his requirements deliberately and with care.

◆ ◆ ◆

Made by

WESTINGHOUSE

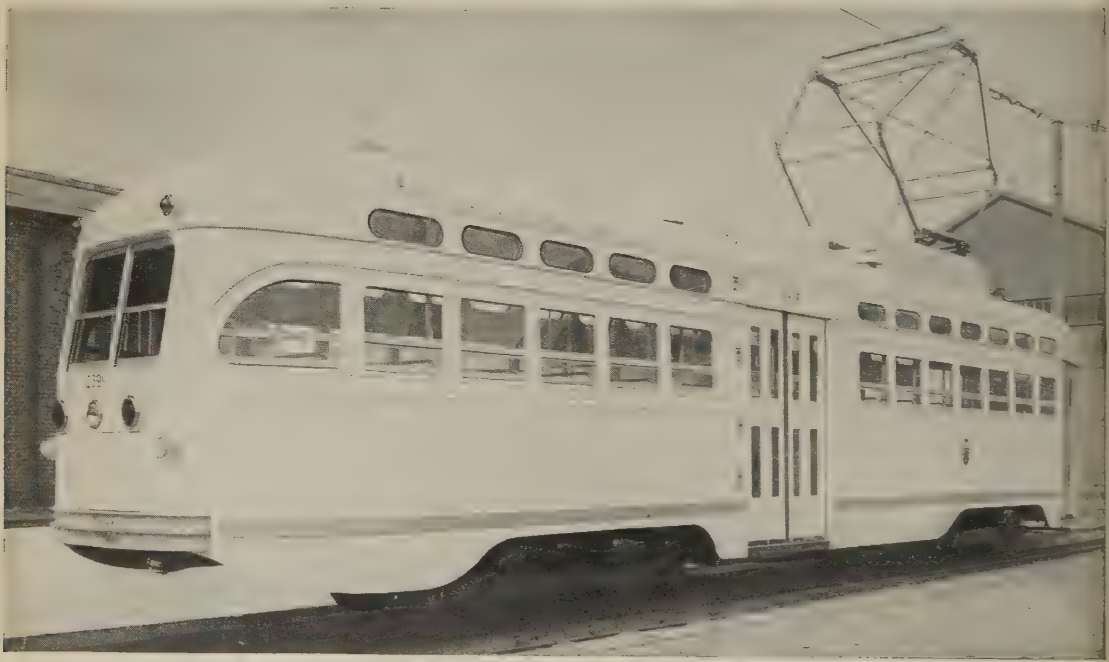


Westinghouse Brake & Signal Co. Ltd., 82 York Way, London, N. 1

**LA BRUGEOISE
ET NICAISE & DELCUVE**

LIMITED LIABILITY COMPANY

Steel-works, Forges and Engineering Works
Head-Office and General Direction at
St-Michel near Bruges



ALL ROLLING STOCK
AND FIXED EQUIPMENT FOR
RAILWAYS AND TRAMWAYS

BRIDGES, FRAMEWORKS, TANKS, GAS-HOLDERS AND ALL
STEEL CONSTRUCTIONS RIVETED AND WELDED

●

WHEEL SETS — STEEL CASTINGS — IRON FOUNDRY
SPRINGS

STONE'S PROVIDE THE BEST FOR THE PURPOSE

railway specialities

for locomotives and carriages

AIR CONDITIONING
EQUIPMENT

STEAM OR DIESEL
LOCOMOTIVE LIGHTING

SMITH-STONE SPEED INDICATOR
FOR LOCOMOTIVES

ELECTRIC WATER HEATING
& ELECTRIC
WATER RAISING APPARATUS

ELECTRIC LIGHTING
EQUIPMENT

ANTHRACITE ELECTRIC
COOKING EQUIPMENT

PRESSURE VENTILATING
& HEATING EQUIPMENT

BRONZE BEARINGS AND
NON-FERROUS
ALLOYS & RIVETS

J. STONE

& COMPANY (DEPTFORD) LTD.

LONDON S.E.14 - ENGLAND

THE J. Stone Group

Sleeping-car
of the Compagnie Internationale
des Wagons-Lits.

52 m^3 tankwagon
for transport of propane.

Double motor-coach.
Supplied to the
Belgian National Railways
(160 km/h).

Wagons – Coaches – Locomotives – Buses – Trolley-buses – Bridges and structures
Heavy and medium pressings.

Elements for pressure pipes – High pressure welded vessels – Springs – Forgings
High pressure flanges – Galvanized sheets.

LES ATELIERS METALLURGIQUES

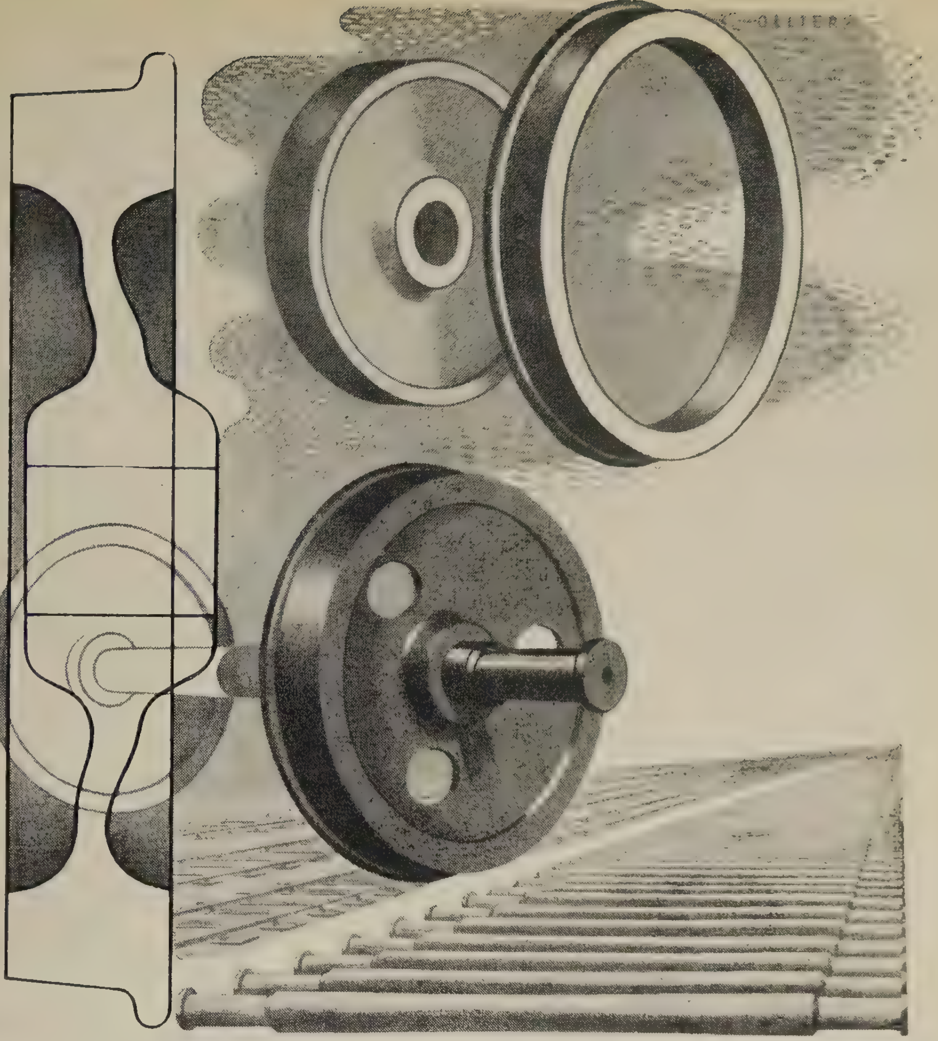
Société
Anonyme
NIVELLES
(BELGIUM)

PREMISES
AND GENERAL MANAGEMENT :
NIVELLES

Works at
NIVELLES – TUBIZE
LA SAMBRE AND MANAGE

Telephone : Nivelles 22 – Telegrams : Metal-Nivelles

EST Editions SCIENCE & TECHNIQUE
21, rue Newton, BRUXELLES



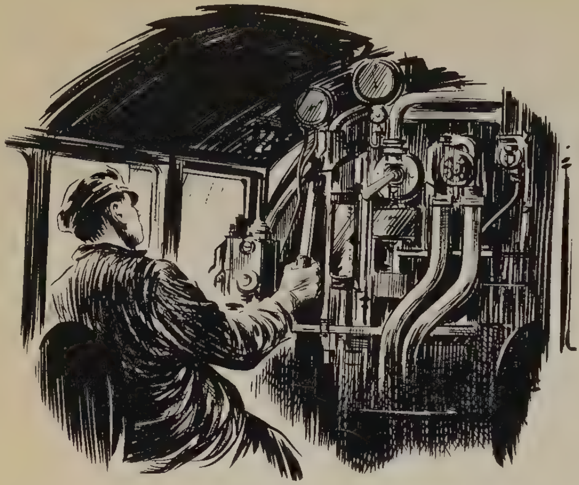
RAILWAY MATERIALS

The Steel Peech & Tozer works is famous for its steel tyres, produced for every kind of rolling stock up to the largest locomotive tyres. Notable are the unusually tough and hard-wearing 'CP' and 'BC' brands, and other specially-treated tyres, much esteemed by railway engineers in many lands. At this works are also produced rolled steel solid wheels, disc centres, locomotive carriage and wagon straight axles, locomotive crank axles and laminated springs.

At the Workington plant high duty wear-resisting Bessemer acid steel rails are made, together with fishplates, bearing plates and steel sleepers.

STEEL PEECH & TOZER · THE ICKLES · SHEFFIELD
WORKINGTON IRON & STEEL COMPANY · WORKINGTON
Branches of The United Steel Companies Limited of Sheffield, England

SP.133



Power in hand –

MeLeSco

SUPERHEATERS
MEAN MORE POWER FROM
STEAM

The **SUPERHEATER** *Company Ltd*

the authority on Superheated Steam

53 HAYMARKET, LONDON, S.W.1. ● Works : TRAFFORD PARK, MANCHESTER, 17

JOHN COCKERILL S. A.
SERAING (Belgium)

DIESEL - ELECTRIC LOCOMOTIVE
« COCKERILL BALDWIN LICENCE »

FIAT 077B RAILCAR IN OPERATION ON GREEK RAILWAYS

RAILWAY JOURNAL AXLE-BOXES

RIV

OFFICINE DI VILLAR PEROSA S. p. A. - TORINO

Alphabetical Index of Advertisers

Firms :		Specialities :
Anglo-Franco-Belge des Ateliers de La Croyère, Seneffe et Godarville (Soc.)	—	Locomotives and railway rolling stock.
Ateliers C F D Montmirail	—	Diesel locomotives and tractors; light railcars.
Ateliers de Construction Oerlikon	—	Electrical equipment for all traction requirements.
Ateliers Métallurgiques (Les)	V	Locomotives and railway rolling stock.
Baume & Marpent (S. A.)	—	Railway rolling stock and fixed equipment.
Belgian National Railway	—	Passenger and freight services.
Bell Punch C°, Ltd.	—	Ticket issuing machines.
British Timken Ltd.	—	Tapered-roller-bearing-axle-boxes.
Brown Boveri & C°, Ltd	—	Electric locomotives.
Brugeoise et Nicaise & Delcuve	III	Railway rolling stock and fixed equipment.
Cockerill (John)	VII	Machinery and metal structures. Diesel-electric locomotives.
Colvilles, Ltd.	—	Fireboxes.
Docker Brothers	—	Paints, lacquers and varnishes for every purpose.
English Electric, Ltd. (The)	—	Railway electrification.
E. V. R. (L'Eclairage des Véhicules sur Rail)	—	Railway lighting equipment.
Ferguson, Ltd.	—	Tractors.
Ferranti, Ltd.	—	Electrical equipment.
Firth (Thos) & Brown (John), Ltd.	—	Railway forgings and tools.
Forges de Courcelles-Centre (S. A.)	—	Draw gear, forged ironwork.
General Steel Castings Corp.	—	Truck beds for locomotives.
German Exhibition, Munich	—	Transport and Communications.
Gresham & Craven, Ltd.	—	Locomotive injectors.
Hasler (A. G.)	—	Speed indicators and recorders.
Imperial Chemical Industries Limited	—	Boiler feedwater treatment.
Isothermos (Société générale)	—	Axleboxes.
H. W. Kearns & C°, Ltd.	—	Machine-tools.
Matisa Equipment Limited	—	Permanent way equipment.
Philips Gloeilampenfabrieken	—	Fluorescent lamps for railway coaches.
Pieux Franki	—	Concrete railway sleepers.
Ransomes & Rapier Limited	—	Railway plant.
RIV (Officine di Villar Perosa)	VIII	Axleboxes.
S. A. B. (Svenska Aktiebolaget Bromsregulator)	—	Automatic slack adjusters.
Sidérur (Société Commerciale de Sidérurgie)	—	Rails, sleepers.
S. K. F. (Société Belge des Roulements à Billes)	—	Axleboxes.
Stone J. & C°, Ltd.	IV	Railway equipment.
Superheater Company (The)	VII	Superheaters for locomotives.
Thomas De La Rue & C°, Ltd.	—	Decoration for the interior of Railway carriages.
United Steel Companies, Ltd. (The)	VI	Railway materials.
Usines Emile Henricot	—	Automatic couplers; steel castings for railway rolling stock.
Vacuum Oil C°, Ltd.	—	Lubricants for locomotives, ships, etc.
Vander Stadt (F. J.)	—	Hydrophilous emulsion for external cleaning of railway carriages.
Vulcan Foundry Ltd.	—	Locomotives.
Westinghouse Brake & Signal C°, Ltd.	II	Railway signalling. Brakes.
Whitelegg & Rogers Limited	—	Fireboxes for locomotives.

M. WEISSENBRUCH & Co. Ltd.
Printer to the King

(Manag. Dir.: P. de Weissenbruch,
238, chaussée de Vleurgat, XL)

PRINTED IN BELGIUM

Edit. responsible: P. Ghilain